



INTEGRITY ENGINEERING, INC.

P.O. BOX 2371 WEST CHESTER, PA 19380-0113 (610) 692-7650

U.S. Patent Nos.: 6,470,696, 6,834,509, 6,886,351, 7,798,159, 8,002,897
Zoggles™ Electronic Anti-Condensation Technology
Tooth Fairy™ UV-Peroxidation Dental Appliance Cleaner/Sterilizer
SPARGE™, EXTRACT™, DISPERSION™ CFD FEA Software

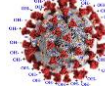
FAX: 610-692-2883
WEB ADDRESS: WWW.INTEGRITYENGG.COM
E-MAIL: INFO@INTEGRITYENGG.COM



NASA Create the Future Winner
International Invention of the Year



Invention of the Year
Zoggles™
Anti-Condensation Technology



Inventors of COVID-19
Destroying UV-Peroxidation
Technology

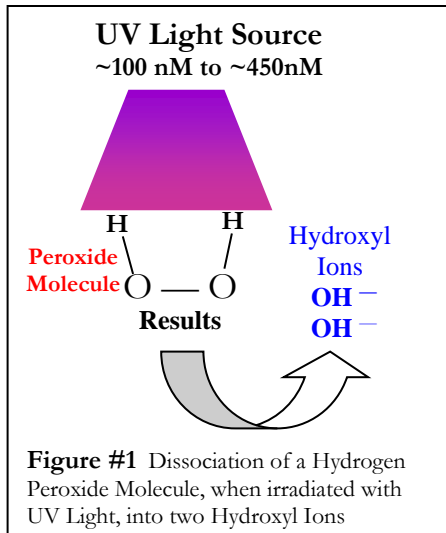
THE DEVELOPMENT OF UV-PEROXIDATION TECHNOLOGY BY INTEGRITY ENGINEERING

A Synopsis of the History of COVID-19 Virus Cell Destroying Technology

By Don A. Skomsky PE
Integrity Engineering, Inc.

I. BACKGROUND

In 2000, while developing new emerging technologies, on our own initiative the Principles of Integrity Engineering (IE) began investigating alternative methods of destroying virulent contagious bacteria, viruses and prions in solutions and on surfaces. During our several-year study we were surprised to discover that the *state of the art* in advanced microbial destruction for over two decades was the application of Ultraviolet (UV) light. Far less effective, to sanitize any object or surface, applying an aqueous solution of a low concentration of Hydrogen Peroxide (H₂O₂) was considered an acceptable secondary but a greatly inferior option to UV light alone. As well, the technical literature was very specific, that to sanitize *any* object, UV light was vastly superior to any other technology and was to be applied alone, and never concurrently



with Hydrogen Peroxide. This is because the Peroxide molecules ‘interfered’ with UV light’s transmittance, greatly lessening the light’s intensity, resulting in poor sanitizing effectiveness. Our research confirmed that this lessening in the intensity of UV light was due to the Peroxide molecules’ single Oxygen-Oxygen (O — O) bonds. When irradiated they almost entirely absorb the UV light photons, rendering what remained of the UV light being greatly reduced and essentially ineffective. By breaking the Oxygen-Oxygen bonds, two negatively charged Hydroxyl Ions (OH⁻) per Peroxide molecule are created. Figure #1 illustrates this chemical reaction.



II. HOW UV-PEROXIDATION TECHNOLOGY DESTROYS VIRUSES & BACTERIA

What the researchers failed to realize and document is that the creation of Hydroxyl Ions by exposing Hydrogen Peroxide to a *specific* frequency range of Ultraviolet Light significantly enhances the chemical destruction of every pathogen to which these Ions are exposed. This destruction is *literally* several orders of magnitude more effective than any other sanitizing process or technology! Recognizing the implications of this irrefutable physical process, after years of research and the acquisition, reading and analysis of *dozens* of technical papers on the subject, in December 2002 we drafted and submitted Patent Application 10/322,648 to the United States Patent & Trademark Office. After an exceedingly lengthy examination period, we were granted US Patent No. 7,798,159. This Patent represented a ‘watershed’ event in that including the device which was cited in our Patent Application, the Principles of IE were granted the first of two US Utility Patents ¹ for the process which has subsequently been ‘coined’ and is now commonly referred to as UV-Peroxidation.

Of particular note is one specific passage in our Patents’ text that succinctly describes how UV-Peroxidation ‘works’ against any pathogen:

“H₂O₂ irradiated by UV light results in the near-complete absorption of the UV light, leading to molecular photolysis of H₂O₂ into constituent hydroxyl (OH) radicals. The chemical interaction of these free, and extremely aggressive, hydroxyl radicals with bacteria and viruses causes the destruction of these pathogens by altering, among other things, their DNA structures. Once chemically altered by the OH radicals, these pathogens either die immediately or quickly mutate such that they cannot replicate, in effect dying shortly afterwards. Thus, although H₂O₂ is an effective biocide by itself, and UV irradiation is effective in killing bacteria and viruses by itself, the combination of H₂O₂ irradiated by UV light can produce a far greater biocidal effect due to photolysis and the creation of sterilizing hydroxyl free radicals.”

Additionally, with this chemical reaction and process, when irradiated with UV light and two Hydroxyl Ions are created per Peroxide Molecule, these Ions immediately ‘attack’ any object in their proximity. Further, anything that is *positively* (electrically) charged acts as a powerful ionic attractor to each *negatively* charged Hydroxyl Ion, creating a strong unbreakable attractive force. This fact is of particular significance when dealing with the COVID-19 virus, because the many spikes on each virus cell are known to be positively charged as is illustrated in Figure #2.

¹ The second US Utility Patent granted to the Principles of IE for UV-Peroxidation is US Patent No. 8,002,897, which was granted on August 23, 2011.



The Development of UV-Peroxidation Technology by Integrity Engineering, Inc.

The way that Hydroxyl Ions 'kill' COVID-19 virus cells is illustrated in Figure #3. After hydrolysis, the Ions migrate to each cell and attach themselves onto the positively charged ends of each spike, one Ion per spike. Though various sources differ in their size data somewhat, the COVID virion is far larger than a Hydroxyl Ion (the diameter of each spherical COVID cell is approximately 100 nanometers ² while each Hydroxyl Ion is of an oval shape approximately .3 nanometers by .35 nanometers, nearly 350 times smaller ³). Hydroxyl Ions easily pass unobstructed through each COVID virus cell wall. Recall that in a COVID virus cell, the only 'object' within it is a strand of RNA. Once inside the COVID cell, each Hydroxyl Ion attacks COVID's RNA and breaks it into various random length pieces. Afterwards, each Hydroxyl Ion bonds to any free Hydrogen atom to produce an inert Water molecule. The entire process takes less than one second of elapsed time.

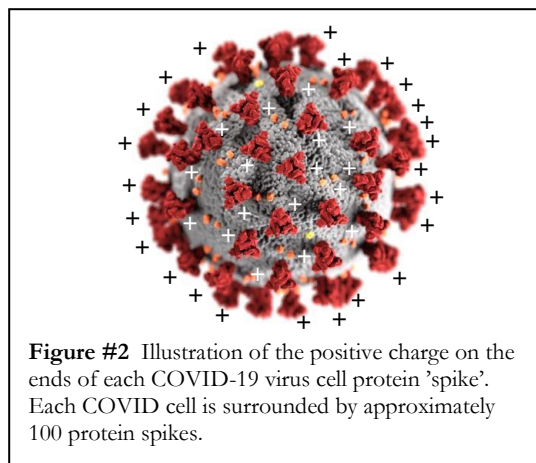


Figure #2 Illustration of the positive charge on the ends of each COVID-19 virus cell protein 'spike'. Each COVID cell is surrounded by approximately 100 protein spikes.

The COVID virion, once changed, cannot replicate. This is true even if the altered cell is inhaled and attaches onto any human cell and its RNA is discharged into a human host cell (such as a nasal, lung or nerve cell). Consequently, the COVID cell 'dies' and it and its cell remnants, including RNA, are removed by the human body's immune system to any nearby lymph node for 'disposal'. When properly executed UV-Peroxidation is the only technology which 'kills' 100% of COVID virus cells, a fact that no other sanitizing process or technology can claim!

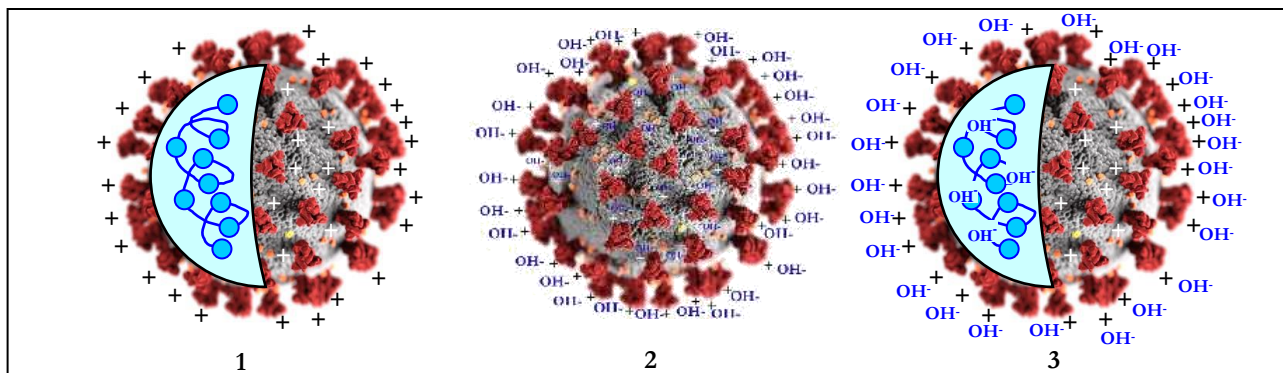


Figure #3 Illustration #1 is a COVID cell depicting its positively charged spikes and its RNA seen through the arc where the cell wall has been removed. In illustration #2 the COVID cell is surrounded by negatively charged Hydroxyl OH^- ions, which have attached themselves onto the ends of the cell's positively charged spikes. In illustration #3, numerous Hydroxyl Ions have migrated through the COVID cell wall and have cut the cell's RNA into multiple sections, making this cell incapable of replicating. This COVID cell, and all others similarly 'attacked' by Hydroxyl Ions, is effectively destroyed.

² Reference *SARS-CoV-2 (COVID-19) by the Numbers*, Michael Eisen et. al. NIH Publication Apr. 2, 2020

³ The size of any atom is not a precise value due to the fact that each is surrounded by one or more electrons, which not only spin but travel in complex 3-dimensional paths in their respective orbitals. These paths are further 'distorted' by the repulsion of bonded atoms' electrons, while concurrently attracted by these same atoms' protons.



III. THE ECONOMICS OF UV-PEROXIDATION TECHNOLOGY

As previously stated, UV-Peroxidation technology requires the application of a low concentration H_2O_2 solution onto any surface (or immersion of any object in such a solution), and afterward illuminating this surface with a ultraviolet light in order to reduce the H_2O_2 molecules to Hydroxyl Ions. Several questions naturally result when considering such action, those being:

- 1) How many total Hydroxyl Ions are produced if a H_2O_2 solution of low concentration, say 5% (by weight), is irradiated by UV light?
- 2) If a subject surface is contaminated with COVID-19 virions at a reasonable concentration, say 1 million cells per square foot, how many square feet of surface will a typical consumer-available container of H_2O_2 treat?, and
- 3) What is the time period anticipated to elapse between the completion of the irradiation of the applied H_2O_2 solution to the complete eradication of all COVID virions on any subject surface?

Employing a 5% H_2O_2 solution in a typical sanitizing effort and assuming that all of the H_2O_2 molecules are reduced to Hydroxyl Ions, the total quantity of Ions produced per a 6 oz. container of the solution is $6.92 \cdot 10^{20}$ Ions! If it is assumed that a more modest volume of Peroxide solution, $\frac{1}{2}$ oz., is applied to a surface by atomized spray, the quantity of Hydroxyl Ions produced amounts to $5.77 \cdot 10^{19}$ OH-Ions. Assuming that every COVID cell spike is occupied by a Hydroxyl Ion (100 spikes per COVID cell), the total quantity of COVID cells that will be destroyed by the Hydroxyl Ions is $5.77 \cdot 10^{17}$ cells. However, if a more modest quantity of spikes per COVID cell are occupied by Hydroxyl Ions, say 5 Ions per cell, then the total quantity of COVID cells that will be destroyed amounts to $1.154 \cdot 10^{19}$ virus cells!

If the latter quantity of COVID cells are present on a surface at a concentration of one million cells per square foot, then the total surface area that can be effectively treated by $\frac{1}{2}$ oz. of H_2O_2 solution amounts to $1.154 \cdot 10^{19}$ virus cells divided by $1 \cdot 10^9$ virus cells per square foot, which equals over $1 \cdot 10^{10}$ square feet! If all 100 spikes per COVID cell are occupied by a Hydroxyl Ion, the surface area effectively treated by $\frac{1}{2}$ oz. of Peroxide solution of 5% amounts to $5 \cdot 10^8$ square feet, an enormous area! The Appendix provides a complete computation of these values.

Once a Hydrogen Peroxide solution is sprayed on a COVID contaminated surface and is subsequently irradiated by UV light, the elapsed time to destroy COVID virus cells by Hydroxyl Ions is less than one second!



The Development of UV-Peroxidation Technology by Integrity Engineering, Inc.

IV. LICENCING UV-PEROXIDATION TECHNOLOGY FOR YOUR FACILITY

As stated in Section II, Integrity Engineering, Inc. and its Principles possess two U.S. Utility Patents for the entirety of UV-Peroxidation Technology, Patent No. 7,798,159 and Patent No. 8,002,897. In order for any individual, corporation, or any business/governmental 'entity' to legally use our patented technology, the individual or a recognized Officer of any US Firm or any US Local, State or Federal Government Agency would be required to obtain a License from Integrity Engineering. Such a License would be readily available once contact by any individual or entity is made with any Principle of Integrity Engineering, negotiations are completed and a Licensing Contract is drawn up and executed. This process need not be overly complex or 'involved', and it is foreseeable that a Licensing Contract may be let within a week or two once negotiations conclude. In such a case, Integrity Engineering, Inc. and its Principles welcome any and all inquiries into its Patented UV-Peroxidation Technology and look forward to serve United States businesses and government entities as it deems appropriate and necessary.

Contact with Integrity Engineering, Inc. (IE) and its Principles may be made via telephone at 610-692-7650, via facsimile at 610-692-2883, or over the Internet at address DSkomsky@IntegrityEngg.com. IE also welcomes individuals, businesses and government officials to view its web site for additional information about IE, its services and accomplishments, as well as project Case Histories, valuable technical information and numerous White Papers across an array of topics at <http://integrityengg.com/index.php?page=technical-papers>.



APPENDIX

- Calculation of the number of Hydroxyl Ions that are created when a 5% aqueous solution of H₂O₂ is irradiated by Ultraviolet Light of a wavelength between 100 nm and 450 nm:

Assumptions:

1. The Peroxide solution is 5% by weight (mass) is contained in a 6 fl. oz. pump spray container,
2. One-half fl. oz. of the Peroxide solution is dispensed,
3. The temperature of the solution is approximately 70° F,
4. The solution is applied as a mist onto a flat surface (examples: grocery store checkout conveyor belt, home countertop, store product shelf, row(s) of common boxed items at grocery or electronic stores, self checkout stations & similar locations,
5. UV light of the correct wavelength range is applied to the Peroxide droplets immediately after the mist is laid, and
6. The COVID-19 virus cells are mostly mature, have 100 ‘spikes’ per cell, each ‘spike’ is positively charged, and each virus cell (virion) possesses a spherical shape 100 nm in diameter.

The quantity of Hydroxyl Ions created by irradiating 6 ounces of H₂O₂ by UV light is:

$$\begin{array}{c}
 \begin{array}{|c|} \hline 6 \text{ ounces} \\ \hline \end{array} \text{ converted} \\ \text{to gallons} \\
 \left[\frac{6 \text{ oz}}{128 \text{ oz/gal}} \right] \cdot \begin{array}{|c|} \hline 8.345 \# \text{mH}_2\text{O} \\ \hline \end{array} \text{ converted} \\ \text{to pounds} \\
 \left[\frac{8.345 \# \text{mH}_2\text{O}}{\text{gal}} \right] \cdot \begin{array}{|c|} \hline \text{Concentration} \\ \text{of Hydrogen} \\ \text{Peroxide} \\ \hline \end{array} \\
 \left[\frac{.05 \# \text{mH}_2\text{O}_2}{1 \# \text{mH}_2\text{O}} \right] \cdot \begin{array}{|c|} \hline \text{Quantity of} \\ \text{Peroxide in} \\ \text{\#m converted} \\ \text{into moles} \\ \hline \end{array} \\
 \left[\frac{1 \text{ Mole H}_2\text{O}_2}{34 \# \text{mH}_2\text{O}_2} \right] \cdot \begin{array}{|c|} \hline \text{Moles of} \\ \text{Peroxide} \\ \text{converted into} \\ \text{Molecules} \\ \hline \end{array} \\
 \left[\frac{6.02 \cdot 10^{23} \text{ Molecules}}{1 \text{ Mole H}_2\text{O}_2} \right] \cdot \begin{array}{|c|} \hline \text{Number of} \\ \text{Hydroxyl Ions} \\ \text{per Molecule} \\ \hline \end{array} \\
 \left[\frac{2 \text{ OH Ions}}{\text{Molecule}} \right]
 \end{array}$$

...Which equals 6.92 • 10²⁰ OH⁻ Ions.

Since the quantity of Peroxide applied is ½ oz., the quantity of OH⁻ Ions will be reduced proportionately to (½ oz/6 oz.) • 6.92 • 10²⁰ Ions, which equals 5.77 • 10¹⁹ OH⁻ Ions! If all of these Hydroxyl Ions occupy COVID cell spikes (100 per virion cell), then the quantity of virus cells destroyed by the Hydroxyl Ions is 5.77 • 10¹⁷ cells. However, more than likely, far less than all 100 of each virion cell spikes will be occupied by nor will require 100 OH⁻ Ions to destroy each COVID cell. Assuming a more likely attachment of 5 OH⁻ Ions per virion, then the quantity of COVID cells destroyed by the total quantity of OH⁻ Ions produced by irradiating ½ oz. of sprayed 5% concentration of H₂O₂ liquid by UV light will be 20 times this figure (100 spikes/5 spikes = 20), or 1.154 • 10¹⁹ virus cells!



The Development of UV-Peroxidation Technology by Integrity Engineering, Inc.

If one assumes that COVID cells are present on a surface in a concentration of 1 million cells per square foot (viz. 10^9 cells/ft²), and that 5 OH⁻ Ions can destroy each COVID cell, given that the number of COVID cells that can be destroyed by ½ oz. of irradiated Peroxide is $1.154 \cdot 10^{19}$, the surface area that can be treated which eliminates all COVID cells by applying just ½ oz. of Peroxide to this surface amounts to an effective treatment area of $1.154 \cdot 10^{19}$ cells \div 10^9 cells/ft² = $1.154 \cdot 10^{10}$ square feet! If each COVID cell requires all of its 100 spikes to be ‘attacked’ by OH⁻ Ions, the effective treatment area for ½ oz. of irradiated Peroxide will be 20 times less, or $1.154 \cdot 10^{10}$ ft² \div 20 = $5.77 \cdot 10^8$ square feet!

It is hardly an exaggeration to state that UV-Peroxidation Technology employed to destroy COVID-19 virus cells and forestall the continuation of the disease is truly an amazing, unequalled sanitizing technology that exceeds all other methods of sterilization.

