Pathogen Path Consulting LLC

Far-UV Sterilray™ Efficacy on Ebola Virus

A non-Technical Interpretation

Summary:

Pathogen Path Consulting, LLC has patented Far-UV Sterilray™ ultraviolet light (222nm) that is specifically designed to break the bonds that hold together the protein molecules that make up viruses like Ebola. Far-UV breaks bonds because its photon energy is greater than the energy of the bond holding the elements of a molecule together. The molecules that form the DNA and RNA are also broken by Far-UV photons. Far-UV Sterilray™ actually causes physical destruction. Consequently, bacteria, viruses[1] (such as Ebola) and spores that are exposed to the Far-UV Sterilray™ light will have critical parts destroyed and cannot remain infectious.

Far-UV Sterilray™ has a number of unique features and advantages. It kills 10 to 1000 more pathogens than other UV processes. In addition, the Far-UV technology kills pathogens in seconds, which is over 10 times faster than other methods. Far-UV causes physical destruction to microorganisms rather than interrupting their ability to reproduce. The Far-UV Sterilray™ kill is permanent, significantly reducing the risk of re-infection. People can work inside a Far-UV light field because it emits very little visible light and any plastic safety or sunglasses will totally absorb Far-UV emission, unlike UV at longer wavelengths. Far-UV Sterilray™ lamps manufactured by High Energy Ozone LLC can be made from magic marker size to over 5" in diameter and 4 feet long to fit any number of applications requiring high-level disinfection. Far-UV Sterilray™ lamps have wide operating temperature range and variable power capability from 30 watts to over 5,000 watts. Far-UV can be used to disinfect skin which can be a significant advantage in preventing the transfer of pathogens.[2]

Far-UV Sterilray™ is a dry, chemical-free process that can quickly disinfect clothes while on the wearer, surfaces, air, liquids and electronics. It can be used to disinfect entire rooms or provide a light curtain to kill any viral spots on protective suits or gloves during the disrobing process.

Far-UV disinfection provides the customer with total confidence of pathogen kill in the shortest amount of time, leaving no chance that it will survive and remain infectious. Far-UV Sterilray™ lamps are mercury-free, turn on and off instantly, which make their use quick, easy and effective for disinfecting small and large areas. Since Far-UV Sterilray™ is safe to use with people nearby, it becomes the only practical application of ultraviolet light for daily, repetitive disinfection tasks. This means savings in time, money and reduced risk of infection.

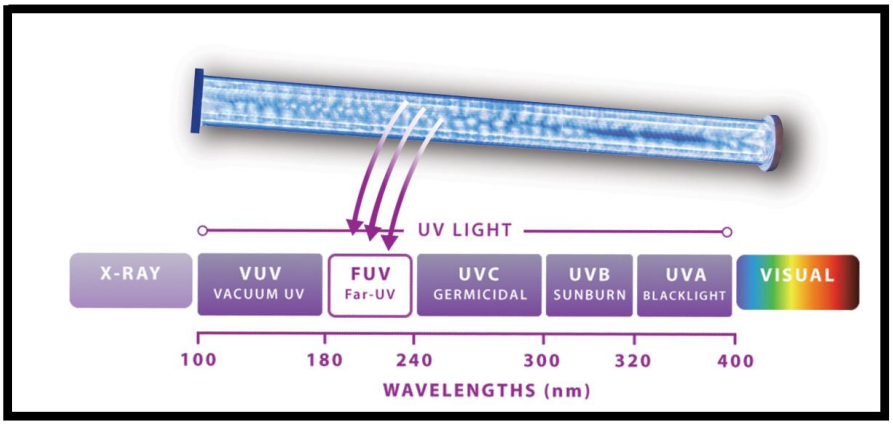
Discussion Details:

Virology, microbiology, photo-biology, photo-chemistry, and their related fields use specific terms that require background and basic study in order to understand the dialogue. This article will provide a non-technical discussion of the concepts and reasoning for the use of Far-UV Sterilray™ Technology as the most effective disinfectant for the Ebola Virus. For those who would like to become more familiar with the Technology, please reference the technical discussion on this same topic.

Light spectrum:

Light is made of photon-like particles that are emitted from the sun or a lamp that hit an object making it appear brighter to our eyes. Visible light has four primary bands with different colors. The blue band has the shortest wavelength. Blue photons have much more energy than red photons, so blue light can have different effects on materials.

The UV light spectrum has multiple bands with different features similar to the visible spectrum. The color difference in the visible spectrum is translated to a letter difference in the UV spectrum. UV bands A, B, and C each have a different effect on skin and eyes. The Far-UV is the blue band in the UV spectrum. It has a shorter wavelength and higher photon energy than the other three UV bands.



Far-UV Sterilray™ is a patented technology that is up to 1,000 times faster than germicidal UV-C.

Microorganism Chemistry:

The Periodic Table lists all of the elements that form every substance and thing we know of. These elements are made up of one or more atoms that are bonded together with rubber band- like structures that can flex, twist, rotate and break. Bio-molecules that make up microorganisms are a collection of these elements bonded together to form long molecules that have three-dimensional shapes. Some of these molecules are proteins, some are molecules that form proteins, and some contain the road map called DNA or RNA which are the blueprints for all living organisms.

Far-UV Features:

Far-UV Sterilray™ Technology is specifically designed to break the bonds that hold protein molecules together and thereby destroys the targeted pathogen. It does this by having a photon energy that is greater than the energy of the bond holding the elements together in the molecule. The molecules that form the DNA and RNA are also broken by Far-UV photons. Far-UV actually causes physical destruction and is not just making chemical changes to these molecules, called dimers, as UV light at the longer wavelengths does. Consequently, bacteria, viruses[1] (such as Ebola), and spores that are exposed to the Far-UV light will be destroyed and cannot remain infectious.

Far-UV Sterilray™ light can be used for skin disinfection. Far-UV is currently being tested to determine the long-term effects on eyes and skin. Numerous tests have concluded that Far-UV Sterilray™ lamps provide a viable alternative for skin disinfection. [2]

How Does Far-UV Work?

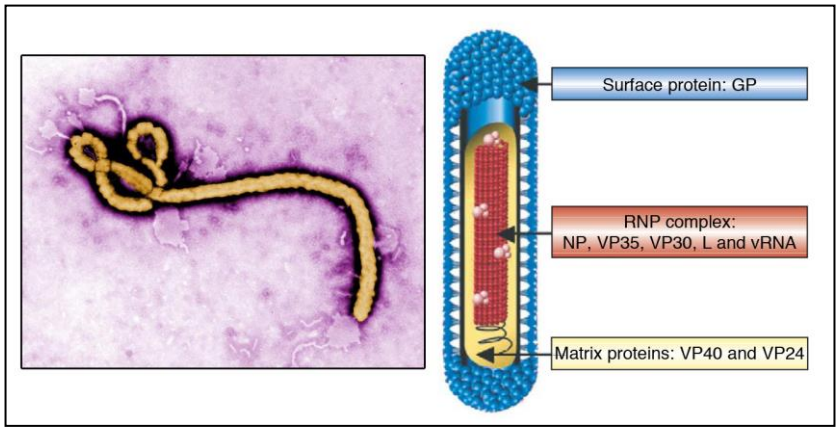
The light emitted from a Far-UV Sterilray™ lamp moves away from the lamp similar to snow falling. The intensity of the light is similar to the rate of falling snow. The amount of energy absorbed by any microorganism (the dose) is similar to snow depth. The dose is dependent on the time of exposure and the intensity (rate of fall) of the light.

Not all chemical bonds absorb light. The proximity and type of molecules that are held by bonds making up the bio-molecules have preferential absorption to different wavelengths of the light that is shining on it. Unless absorption occurs, nothing happens to the molecules.

For example, if a red balloon is put inside a white balloon and a red laser is directed towards it, the red balloon will pop, but the white balloon will remain expanded because no absorption took place in its skin.

Ultraviolet light, in the other three bands, has longer wavelengths and less photon energy. Thus, their photons cannot break chemical bonds, but they actually change the chemical bond structure (called a dimer). With this new structure intact, the microorganism cannot reproduce, so infection doesn't occur. However, this structure is reversible and if that occurs, the organism can start to reproduce and re-infect again.

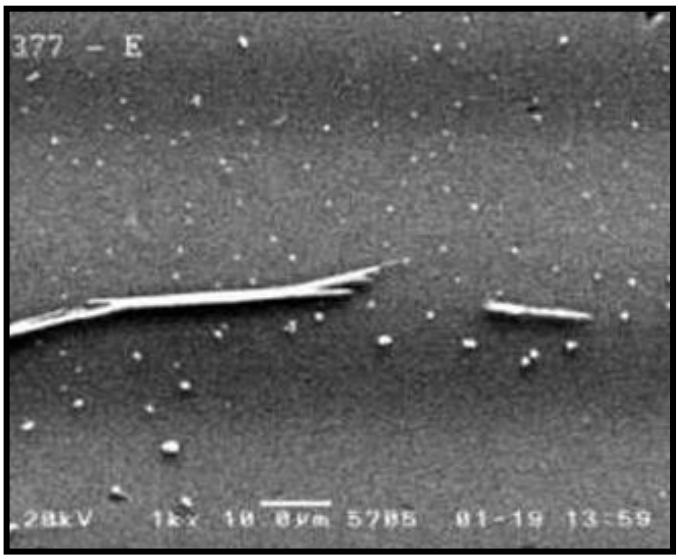
The Ebola virus is a large virus and uses many different enzymes to make it infective. Since its RNA-negative strand is non-infective, it makes the infective RNA-positive strand during a duplicative process. RNA lacks effective verification and control mechanisms. It could actually bypass the dimer formed in the negative strand RNA and produce an infective mutation in the positive strand RNA which is not an identical copy.



A report[3] shows this virus has already mutated over 300 times before the 2014 epidemic. Unlike Far-UV Sterilray™ light, UVC light may actually promote reactivation and mutations of the Ebola virus.

A 1995 Russian paper[4] reported that UVC did very poorly against *live* Ebola virus having almost no affect for the first 10 minutes of exposure. This would indicate there is a large amount of enzymes available to correct dimer formation almost as fast as they are formed.

When proteins and the basic chemicals that make up the DNA and RNA of the microorganism absorb Far-UV light, some bonds will break. When these bonds break, it critically affects the survival and replication ability of the organism. A micrograph on the right shows where Far-UV actually ruptured the sidewall of a bacteria outer spore coat that is rich in proteins and segmented part of it. Similarly, destroying one or more of the 7 critical proteins in the Ebola virus will permanently destroy the organism's ability to survive and its ability to replicate.



[1]Over 40 tests have been conducted by independent lab facilities using Far-UV Sterilray™ to test its killing ability on many pathogens including MRSA, VRE, and C. diff spores. Few viruses are similar to negative-sense single-stranded Ebola virus. Positive-sense single-stranded viruses that have been tested include: Rhinovirus, the very large Coronavirus, and the very small Feline calicivirus (FCV). Test reports are available upon request.

[2]For those who would like to become more familiar with the technology, please reference the technical discussion on this same topic. Testing the use of Far-UV for skin disinfecting is in process but is not currently FDA approved.

[3] Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak: Stephen K. Gire et al.; Science 345, 1369 (2014); DOI: 10.1126/science.1259657

[4] Effect of chemical and physical factors on inactivation of the virus Ebola; A.A. Chepurnov, Y.P. Chueyv, O.V. Pyankov, I.V. Efimova; Voprosy Virusologii; 1995 Mar-Apr; 40(2):74-76: PMID: 7762236 {request a free translated version from info@sterilray.com }