EFFECTIVENESS OF THE PURITY LIGHT UVC SANITIZER IN FIELD TESTING

08/20/2020

Foreword:

Ultraviolet light is a component of the electromagnetic spectrum that falls in the region between visible light and X-Rays. Most natural UV light is generated by the sun with about ten percent of sunlight being UV and only about three to four percent penetrating the atmosphere to reach the ground. Of the UV radiation that reaches the earth, 95 percent is UVA and five percent is UVB.

No measurable UVC from the sun reaches the earth's surface. Because of the spectral sensitivity of DNA, only the UVC region demonstrates significant germicidal properties.

As evident by multiple research studies and reports, when biological organisms are exposed to deep UV light in the range of 200 nm to 300 nm it is absorbed by DNA, RNA, and proteins. Absorption by proteins can lead to rupture of cell walls and death of the organism. Absorption by DNA or RNA (specifically by thymine bases) is known to cause inactivation of the DNA or RNA double helix strands through the formation of thymine dimers. If enough of these dimers are created in DNA, the DNA replication process is disrupted, and the cell cannot replicate.

The Purity Light UVC Sanitizer specifications emit light in the peak wavelength of 253.7 nm at 107 uW/cm2 per bulb by using two 30 watt mercury arc bulbs. The light is powered by 120 volts at 60HZ. Total output of the light is 207 uW/cm2.

1. **Purpose**: This document explains the testing of the Purity Light in a field test for efficacy.
2. **Application Overview**: The Purity Light UVC sanitizer is a device used for sanitizing the air and contact surfaces with UVC light at 254 nanometers to decrease or eliminate organisms. UVC light has been studied and known to inactivate viruses, bacteria and fungal organisms.
3. **Testing Scope**: Inactivation of bacteria on a surface with the Purity Light.

4. **Test Assessment**: The testing met objectives based on real time in field metrics for typical use for CFM air flow, temperature, and organisms found in professional settings involving humans. Reasonable time constraints associated with testing was found to be ample for professional use as directed by product catalog and previous UVC research. Although separate organisms such as viruses could be tested, it would remain redundant due to difficulty culturing such organisms and the depth of research demonstrating the frailty of such compared to bacteria. In lieu of these facts a reasonable conclusion can be achieved based on results regarding the ability of such light to inactivate viruses.
5. **Test Results**: The Purity Light UVC sanitizer inactivated the surface of a vinyl chair at 5 minutes to produce no aerobic bacteria on culture 08/13/2020.
6. **Materials and Methods**:
    a. A vinyl patient chair used in a professional healthcare setting was used as the test subject for the colonization of bacteria. The chair was inoculated with three separate hand wipes from three participants as well as coughing on the chair to elicit normal oral flora. The chair was swabbed after 5 minutes time in a temperature-controlled room at 69 degrees Fahrenheit in a room with no sunshine on the chair. A culture was taken with a lazy S formation at a 45-degree angle with minimal pressure on the swab as to not deform the shaft. A black permanent marker was used to denote the beginning, full arch of the S and the completion point of the sample. Fluorescents T8 lights are used to illuminate the room. The air flow is 100 CFM. Relative humidity was 55%. The Purity Light UVC sanitizer was arranged 30 inches from the subject in a 90-degree orientation. The light was operated for a total of 5 minutes at 214 micrometers/cm squared output. The door to the room remained closed until completion of the test without human presence. The subject was then cultured again in the same manner, direction, and location as the first swab. The specimens were immediately placed in swab solution and capped in place as sample 1 (first swab) and sample 2 (second swab) after completion of each individual pass on

the subject. The specimens were transported via courier to North Alabama Medical Center microbiology department for culture plating. The cultures according to the hospital guidelines were then incubated for a total of 48 hours.

b. **Culture results**: The first sample demonstrated bacillus species of bacteria. The second sample demonstrated no growth of bacterial organisms.

Lesson learned: The study demonstrated the Purity Light UVC sanitizer does indeed inactive bacillus species on a vinyl surface after just 5 minutes. Based upon this data set much can be inferred from previous studies of UVC light usage for the destruction of viruses, bacteria and fungal organisms and as the to the virility of the said Purity Light. Difficulty in determining the bacterial colonization and count would have been beneficial in the study to perhaps show the light could be used at even lower power usage prior to use of the Purity Light. Due to the nature and requirements of time to colonize a culture, it would have negatively impacted the study in such a manner. In lieu of these limitations, bacillus species is a difficult organism to inactivate as compared to other bacteria demonstrating the power of UVC light on surfaces. Viruses are an even more difficult species to inoculate a surface and thus swab to demonstrated inactivity. Typically, this testing modality is done in solution which again increases the difficulty of testing our subject. The report examines the use of the light against bacteria which clearly demonstrates the effectives of the Purity Light UVC device and irradiance to other organisms.