Crystal IS

APPLICATION NOTE | AN013 | AUGUST 10, 2016

Disinfecting Microbes with Crystal IS Klaran UVC LEDs

Established data-based evidence about Klaran's performance for disinfection determined by Pathogen testing on various microbes.

Introduction

Ultraviolet (UV) disinfection has become a reliable and viable alternative to chemical disinfection methods due to the increased awareness of chemical-resistant microbes and the presence of harmful by-products. UV disinfection relies on radiation emitted in the wavelength range of 250 nm to 280 nm (UVC) to inactivate pathogens. Commercial UV technology solutions developed during the past 30 years use low and medium pressure mercury lamps, however these light sources pose other issues around environmental friendliness and design flexibility. There is tremendous development in semiconductor-based UVC light emitting diode (LED) technology as an efficient, cost effective and environmentally friendly alternative to mercury-based technology.

This application note outlines the effectiveness of Klaran UVC LEDs and the level of disinfection achieved on different microbes across a range in gram positive, gram negative and fungi groups as a function of time and distance.

Microbiology Study

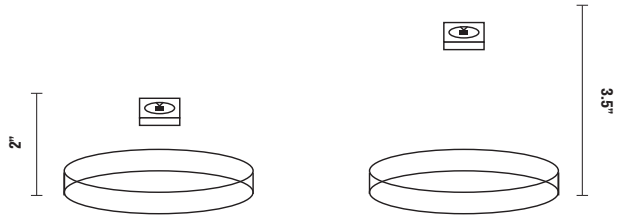
Experiments conducted at EMSL, a third-party microbiological testing facility in New York, used common target microbes from disinfection applications (Table 1).

TABLE 1

MICROBE	TYPE
MRSA	Gram + Bacteria
Staphylococcus aureus	Gram + Bacteria
Staphylococcus epidermidis	Gram + Bacteria
Enterococcus faecelis	Gram + Bacteria
Pseudomonas aeruginosa	Gram - Bacteria
Acinebacter baumanii	Gram - Bacteria
Clostridium difficile	Gram + Bacteria (spore forming)
Candida albicans	Fungi

The experiments used a single Klaran UVC LED with an output power of 20 mW. Two set ups were used with a distance from the light source to the microbe of 2 inches and 3.5 inches (Figure 1).

FIGURE 1



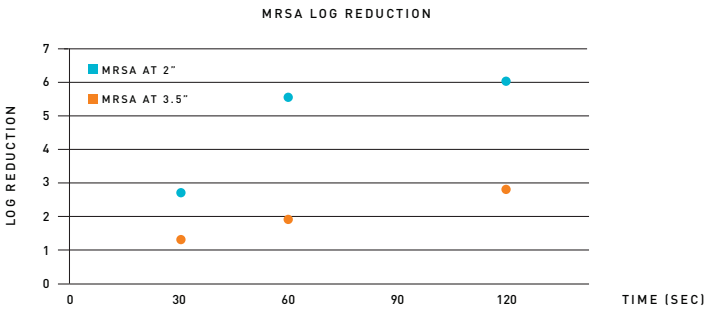
Experiment set up for microbiological testing to determine impact of distance on log reduction of microbes.

The log reduction for each microbe was measured after UV exposure intervals of 30, 60 and 120 seconds. For more information on log reduction, see Crystal IS application note AN002.

Results Summary

Figure 2 shows the results of the exposure testing for MRSA at various time intervals and distances from the light source. The figure shows that approximately 120 seconds are required to achieve a 6 log reduction of MRSA at a distance of 2 inches from the light source.

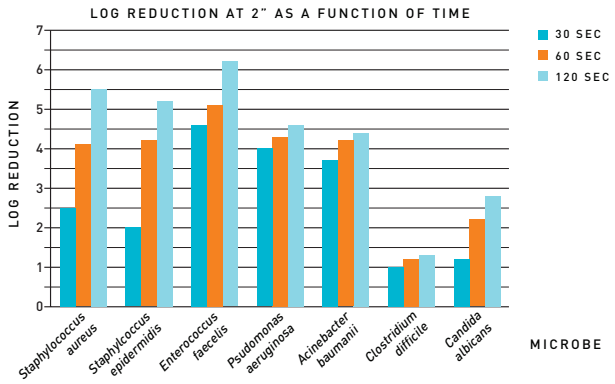
FIGURE 2



MRSA log reduction as a function of distance and time using Klaran LEDs.

The exposure data for the remaining microbes can be seen in Figure 3 and 4 at distances from the light source of 2 inches and 3.5 inches respectively. After 120 seconds of exposure at a distance of 2 inches, the data shows that there was slightly more than a5.3 log reduction on all the gram positive bacteria. Bacteria of gram negative type experience a log reduction value between 4 and 5; fungi had a log reduction value of approximately 3 and gram positive (spore forming) experienced just over a 1 log reduction. 3.

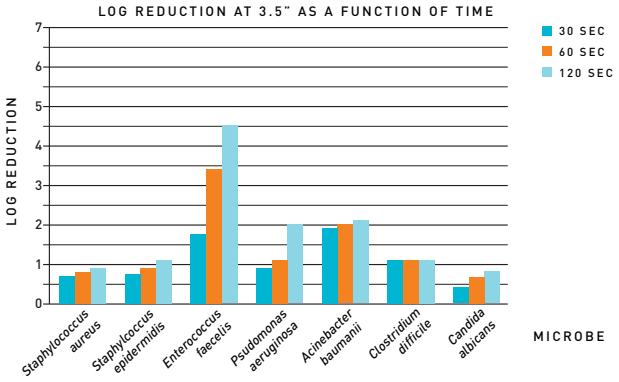
FIGURE 3



Log reduction as a function of time for various microbes at 2" distance.

At a distance of 3.5 inches, the log reduction follows a similar trend, albiet less powerful, for the gram negative and fungi microbes. The gram positive and gram positive (spore forming) microbes follow a less predictable pattern with the increase in distance. This may be attributed to the dosage required for complete inactivation of the microbe.

FIGURE 4



Log reduction as a function of time for various microbes at 3.5" distance.

The results of these experiments show that when the distance is increased and time and UVC power are held constant, the log reduction is lower. However, this decrease in disinfection occurs in an unpredicable fashion, so although dosage calculations provide guidance on application design, they should be validated through microbiology studies. The experiments outlined in this application note are for reference only and should not supplement microbiology testing in specific application designs.

Crystal IS Meets Your Disinfection Application Needs

UV radiation can be an incredibly effective resource for disinfection applications, and Crystal IS has created a unique product that overcomes obstacles traditionally associated with UV light sources. Its lifetime expectancy and reliability can exceed other UV light sources, and the instant on/off feature which is inherent to solid state devices (unlike its plasma gas counterparts) further increases useful life. The UVC LEDs are safe and eco-friendly, and offer design flexibility that other UV sources cannot match, offering an efficient, cost-effective option for disinfection applications.

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WE INVITE YOU TO LEARN MORE ABOUT OUR UVC LEDs.

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