

ON-DEMAND *DISINFECTION*

GETS THE DOSE CLOSE

The only portable UV-C system that positions light vertically, horizontally and angled for optimized disinfection delivering more UV dose in less time than the competition

Ideal for hospital rooms, operation theaters, long-term care facilities & public transport



MoonBeam 3™

DISINFECTION TECHNOLOGY

Distributed by Daylight Medical

Introduction

Healthcare associated infections (HAIs), particularly those caused by multi-drug-resistant organisms (MDROs) represent a significant impact on patient morbidity and mortality and increase the financial burden on healthcare systems. Contaminated environmental surfaces have been shown to be an important source for transmission of HAIs. Effective cleaning and disinfection can decrease environmental pathogens, reducing the risk of infections, but hospital environments are complex, which can often result in cleaning that is inadequate.

To offset these challenges, adjunct technologies such as UV-C disinfection have been introduced to enhance the effectiveness of manual disinfection, particularly in hospital settings where healthcare associated infections are of major concern. UV-C has long been proven as an effective technology to reduce contamination and the potential for infection by using short-wavelength ultraviolet (UV-C) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions.

There are many UV-C devices offered in the market with varying designs. Since UV-C disinfection involves light waves, it is important to ensure these devices are in "line of sight" to those surfaces most likely to be contaminated or frequently touched in a patient environment. As demonstrated in several studies¹, the power and speed of UV-C disinfection can be impacted by distance and angle. The strength of the UV-C light dose decreases the further away it gets from the light source, following the inverse square law. Because of this, the design of the UV-C device can impact the strength of dose applied to surfaces, impacting the level and speed of disinfection.

A third-party lab in the United States was engaged to conduct laboratory testing to evaluate the antimicrobial activity of the MoonBeam3 UV device. The test results are reported in a study that supports and expands on previous third party studies performed in the USA¹ confirming the effectiveness of this device to combat organisms including carbapenem-resistant *Klebsiella pneumoniae* (ATCC BAA-1 705), methicillin-resistant *Staphylococcus aureus* - MRSA (ATCC 33592), and *Clostridium difficile* - spore form (ATCC 43598).

The study evaluated the MoonBeam3, a portable UV disinfection system unique to the market in its design, size and performance. The device is designed with articulating arms that enable the user to optimize the UV dose by adjusting for the angle of incidence and distance of the device from surfaces to enhance the UV level and speed of disinfection.



Methods

The study examined the effectiveness of the following ▶

Bacterial cells and spores were inoculated and dispersed onto the surfaces of glass specimen carrier plates. The carriers were dried and then exposed to the UV device for the applicable exposure time. After exposure, the carriers were neutralized and assayed for survivors.

The exposure distance was set at four (4) feet (1.21 meters) and the environment was at room temperature. There were three replicate carriers per parameter (test) and three population control carriers per organism (longest time point only).

Test Organism	ATCC#	Growth Medium	Incubation Parameters
carbapenem-resistant <i>Klebsiella pneumoniae</i>	BAA-1705	Nutrient Broth	35-37°C, aerobic
methicillin-resistant <i>Staphylococcus aureus</i> - MRSA	33592	Synthetic Broth	35-37°C, aerobic
<i>Clostridium difficile</i> - spore form	43598	CDC Anaerobic Blood Aqar	35-37°C, anaerobic

¹(USA tested and published data) Enhanced terminal room disinfection and acquisition and infection caused by multidrug-resistant organisms and *Clostridium difficile* (the Benefits of Enhanced Terminal Room Disinfection study): a cluster-randomised, multicentre, crossover study, Anderson DJ, et al. *Lancet* 2017;389(10071):805-14
Effect of Variation in Test Methods on Performance of Ultraviolet-C Radiation Room Decontamination, Jennifer L. Cadnum, et al. *Infection Control & Hospital Epidemiology* / Volume 37 / Issue 05 / May 2016, pp 555 - 560
Relative Resistance of the Emerging Fungal Pathogen *Candida auris* and Other *Candida* Species to Killing by Ultraviolet Light, Jennifer L. Cadnum, et al. *Infection Control & Hospital Epidemiology* January 2018, vol. 39, no. 1
Impact of Room Location on UV-C Irradiance and UV-C Dosage and Antimicrobial Effect Delivered by a Mobile UV-C Light Device, John M. Boyce, MD et al. *Infection Control & Hospital Epidemiology* June 2016, Vol. 37, No. 6

There were three test slides and three control slides.

1. Exposure of inoculated plates to UV light
 - a. No soil testing
 - i. Three minutes for MRSA, three minutes for CRE and three minutes for *C. diff*
 - ii. Ten minutes for *C. diff*
 - b. With soil testing (Five percent Fetal Bovine Serum)
 - i. Three minutes for *C. diff*
 - ii. Ten minutes for *C. diff*

The carrier population control results were as follows ▶

Test Organism	Average Log ₁₀
carbapenem-resistant <i>Klebsiella pneumoniae</i> (ATCC BAA-1705)	7.64
methicillin-resistant <i>Staphylococcus aureus</i> - MRSA (ATCC 33592)	7.46
<i>Clostridium difficile</i> - spore form (ATCC 43598) – (no soil)	6.39
<i>Clostridium difficile</i> - spore form (ATCC 43598) – (soil)	6.40

USA Lab Test Results

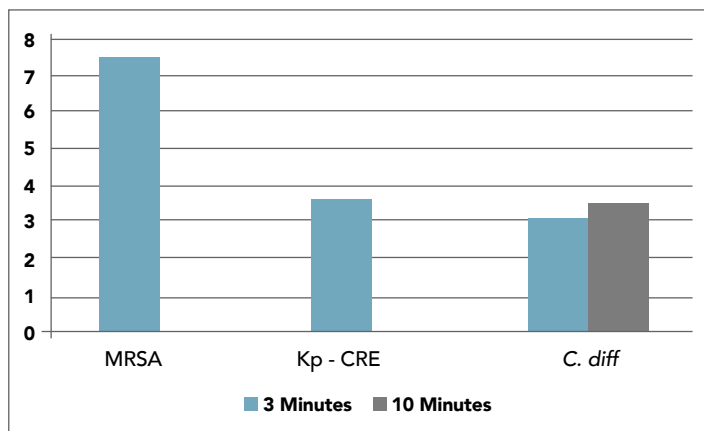
When performing UV disinfection, with no soil, more than 3.61 log₁₀ reduction of vegetative bacteria colonies of carbapenem-resistant *Klebsiella pneumoniae*, and 7.46 Log₁₀ reduction for MRSA was observed after UV-C irradiation of three minutes at a distance of four (4) feet (1.21 meters) from the device. For spores, the average log₁₀ reduction was 3.06 with no soil at three minutes, and 3.51 at ten minutes.

Test Results - UV Only

Test Organism	Average Log ₁₀ Reduction (3 min.)	Average Log ₁₀ Reduction (10 min.)
carbapenem-resistant <i>Klebsiella pneumoniae</i> (ATCC BAA-1705)	3.61	N/A
methicillin-resistant <i>Staphylococcus aureus</i> - MRSA (ATCC 33592)	7.46	N/A
<i>Clostridium difficile</i> - spore form (ATCC 43598) – (no soil)	3.06	3.51



MoonBeam Log Reduction (without soil)





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What makes MoonBeam3 unique

- Telescoping arms enable horizontal, vertical and angled UV-C light to “get the dose close” to deliver more UV dose in less time than the competition
- Proven efficacy, third-party antimicrobial effectiveness laboratory tested
- Highly-effective disinfection in as little as three minutes
- Designed and manufactured in an EPA registered facility
- Hospital environment designed & certified; high-output UV-C 254-nanometer germicidal spectrum
- Suited for whole-room or targeted high-touch surface/equipment disinfection
- Rugged design for mobility
- Size, weight, height enable fast deployment where and when needed
- Uniquely designed for deployment and use in compact spaces
- Safety features turn off UV-C bulbs when motion is detected via physical accelerometers (touch or movement) and infrared motion sensors (body heat)

Easy-to-use

1. Plug it in
2. Position the arms
3. Place the remote cover outside the area where disinfection is taking place
4. Press start

That's it! When not in use, the remote cover houses the complete system for easy transport and storage.



Versatile and effective UV-C disinfection

MoonBeam3 delivers powerful UV-C germicidal light to provide fast, on-demand broad area disinfection of high-touch surfaces in as little as three minutes. Exclusive to MoonBeam3 are its three articulating heads that can be positioned vertically, horizontally and angled to “get the dose close” and direct the UV-C light to disinfect surfaces from six inches (15.24 centimeters) to more than seven feet (2.13 meters) from the ground and six feet (1.82 meters) outward. With proven efficacy of up to a 6-log reduction (99.9999)*, third-party testing on several microorganisms including enveloped viruses, small non-enveloped viruses, bacteria and bacterial spores have been performed using MoonBeam3, and demonstrated a significant log reduction in pathogens. This efficacy data demonstrates the effectiveness of the MoonBeam3 device on pathogens that are more difficult to kill than enveloped viruses such as SARS-CoV-2. Used in the world's leading hospitals to reduce the spread of HAIs (healthcare-associated infections) such as MRSA, VRE, MDR-Gram negative, norovirus and *C. diff* spores, its unique design is ideal for tight spaces such as emergency transport vehicles yet effective in larger spaces such as hospital rooms, operating theaters, long-term care facilities, bathrooms, dining areas, and other shared spaces.

Not all UV-C is created equal

It's important to note that not all UV-C is created equal. While many UV-C devices are large, expensive, difficult to use, and restricted in terms of deployment, others lack enough dose (e.g. power) to be effective against pathogens. They are often too heavy, too wide and too tall for tight spaces, and not designed for the ruggedness required in transport. These various sized UV-C systems have bulbs that are limited to vertical-only positioning and lack the ability to effectively disinfect horizontal surfaces.

While UV-C is one of the most effective methods of disinfection, power, proximity, distance and angle of the light are very important. MoonBeam3 is uniquely designed for environments other systems simply cannot disinfect. It's UV-C when and where you need it for on-demand disinfection at the required germicidal frequency, providing the right power in the right time and the right angle of incidence to targeted surfaces.

PROVEN WORLD CLASS LAB TESTS RESULTS

Japan - Live Strain Covid-19 Virus Test, Fujita Health University, Japan:

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), obtained from Kanagawa Prefectural Institute of Public Health, Japan; (SARS-CoV-2/Hu/DP/Kng/19-020). Bio Safety Cabinet 3 level lab exposures controlled from 0~5 seconds duration

Third-party independent lab antimicrobial effectiveness testing in the United States, Wide Range of Pathogens, proves MoonBeam3 efficacy:

Test Organisms						
Test Application: MoonBeam3 254nm System Single emitter, 40cm. Biosafety Cabinet exposure						
Exposure Time	Carrier #	TCID50/mL	Log ₁₀	Average Log ₁₀	Geometric Mean	Percent and Log ₁₀ Reduction
0 sec	1	3.16x10 ⁶	6.50	6.63	4.33x10 ⁶	0.00% 0.00 log ₁₀
	2	5.62x10 ⁶	6.75			
	3	4.22x10 ⁶	6.625			
0.5 sec	1	7.50x10 ⁴	4.875	4.75	5.78x10 ⁴	98.7% 1.88 log ₁₀
	2	4.22x10 ⁴	4.625			
	3	5.62x10 ⁴	4.75			
1.0 sec	1	5.62x10 ³	3.75	3.83	7.73x10 ³	99.8% 2.79 log ₁₀
	2	1.33x10 ⁴	4.125			
	3	4.22x10 ³	3.625			
1.5 sec	1	1.33x10 ³	3.125	2.96	9.65x10 ²	99.98% 3.67 log ₁₀
	2	1.00x10 ³	3.00			
	3	5.62x10 ²	2.75			
2.0 sec	1	1.33x10 ²	2.125	2.42	2.90x10 ²	99.99% 4.21 log ₁₀
	2	3.16x10 ²	2.5			
	3	4.22x10 ²	2.625			
4.0 sec	1	nd	nd	nd	nd	nd ~99.9999% >6.0 log ₁₀
	2	nd	nd			
	3	nd	nd			

Test Organism	Distance to Organism	Exposure Time	Log ₁₀ Reduction	% Reduction
Enveloped Viruses				
Influenza A virus, ATCC VR-544, Strain A/Hong Kong/8/68	1.2 m	3 min	>5	99.999
Respiratory Syncytial Virus (RSV)	1.2 m	3 min	>4	99.99
Gram Negative Bacteria				
CR Escherichia coli (CDC 81371) - (carbapenem-resistant, CRE)	1.2 m	3 min	>5	99.999
MDR Acinetobacter baumannii (ATCC BAA-1605)	1.2 m	3 min	>4	99.99
Pseudomonas aeruginosa (ATCC 15442)	1.2 m	3 min	>5	99.999
Gram Positive Bacteria				
Enterococcus faecalis - VRE (ATCC 51575) (Vancomycin-resistant; VRE)	1.2 m	3 min	>4	99.99
methicillin-resistant Staphylococcus aureus - MRSA (ATCC 33592)	1.2 m	3 min	>6	99.9999
Non-Enveloped Viruses				
Norovirus (via feline calicivirus surrogate)	1.2 m	3 min	>4	99.99
Poliovirus	1.2 m	3 min	>5	99.999
Tuberculoacidal				
Mycobacterium bovis (TB surrogate)	1.2 m	3 min	>4	99.99
Spores				
Clostridium difficile - spore form (ATCC 43598) - no soil	1.2 m	3 min	>3	99.9
Clostridium difficile - spore form (ATCC 43598) - with soil (5% fetal bovine serum)	1.2 m	3 min	>3	99.9

Specifications

BULB (Lamps):

3 x Diversey supplied UV-C bulbs, 95 watts

- (3) High-output soft glass, single ended double tube UV-C bulbs. Each emitters 95W, 350uW/cm² per emitter ⁽¹⁾
- UV-C efficacy life monitored and controlled by the system to 600 hours
- UV-C head physical range: 6" (15 cm) to 84" (210 cm) high
- High continuous power ballasts
- Cycle time in seconds: 90, 180, 300, 600
- Applied dose: 75mJ 2' (.60 meter) 180 seconds; dose is accumulative based on exposure time
- Device weight: 39 pounds (17 kg) complete
- Base unit: 27 pounds (13 kg)

ECOLOGICAL: Environmental: No germicidal ozone generation, high output low pressure mercury UV-C lamps

- Device size: 15" x 44" (38 cm x 112 cm)
- Acoustic noise: negligible db
- Power: 100-120V~, 3.2A, 50/60Hz, 200-240V~, 1.6A, 50/60Hz

(1) Lamp data is based on measurements performed under laboratory conditions in air at room ambient temperature. Measurements were performed on a high-frequency, current limited electronic ballast, 50/60 Hz, and represents 10 bulbs average uW/cm² values at 1.2 meter.

Warranty

One year Return-to-Factory Warranty on the MoonBeam3 device, excluding bulbs. No tools required for bulb replacement.

Regulatory

This product is in conformity with the requirements of EC Council directive MDD93/42/EEC and satisfies the Class A limits of IEC60601-1-2 for healthcare environments. Conforms to IEC/EN/UL 61010-1, Certified to CAN/CSA Std C22.2, Nos. 61010-1.



Call Daylight Medical today at **800-459-8500** or visit **www.daylightmedical.com** for more information.

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