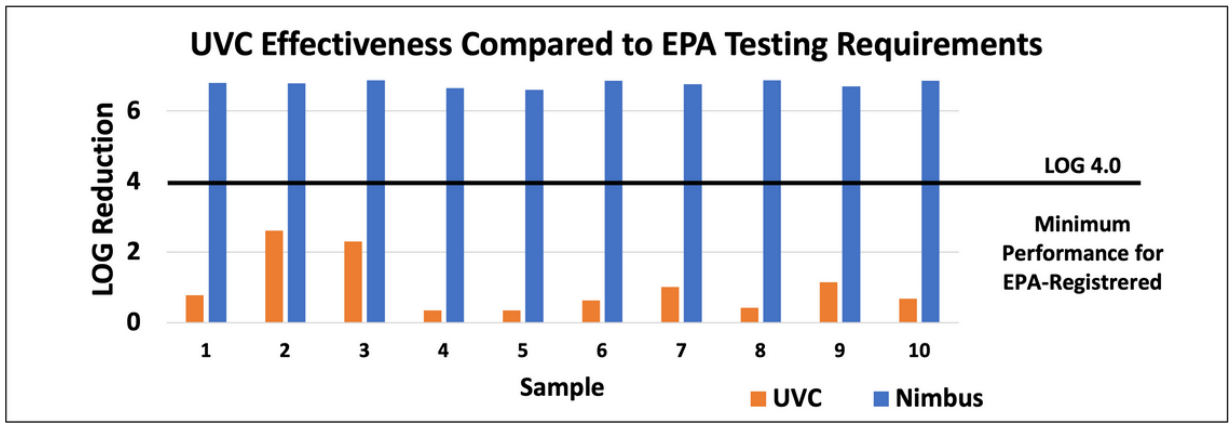
UVC simulated EPA testing protocol for Hospital Grade Disinfection compared to Whole Room HOCL fogging technology

Abstract: Healthcare Associated Infections (HAIs) are an enormous problem for patients and acute healthcare facilities. To reduce HAIs, many hospitals are employing innovative technology to supplement manual cleaning practices in their quest to combat pathogens in their facility. Whole room fogging technology and UVC light technology are two technologies being used in today's healthcare environments.

Method: Scientists at the University of Arizona College of Public Health used a simulated hospital-room environment to conduct testing of a UVC tower against S. aureus 6538 using AOAC methods to judge efficacy consistent with EPA registration protocols for a hospital grade disinfectant classification.

Results: The UVC tower achieved 90.45% mean disinfection efficacy or a LogReduction = 1.02, far below required minimum performance necessary to be achieve a hospital-grade disinfectant classification by EPA standards. By comparison, the whole room HOCL fogging robot achieved greater than 99.9999% mean disinfection efficacy or a Log Reduction =6.77.

Conclusion: By comparison, the typical UVC disinfection efficacy is vastly lower than the whole room HOCL fogging technology for a variety of factors.



ABSTRACT

Healthcare Associated Infections (HAIs) are an enormous problem for patients and acute healthcare facilities. The impact of HAIs is detrimental to patient outcomes and increases the cost of provider care. In hospitals alone, the Centers for Disease Control and Prevention (CDC) estimate HAIs account for 1.7 million infections and more than 98,000 deaths each year. Approximately $45 billion in direct hospital costs are associated annually for the treatment of HAIs. To reduce HAIs, many hospitals are employing innovative technology to supplement manual cleaning practices in their quest to combat pathogens in their facility.

Technology, such as a whole room fogging system whose active ingredient is Hypochlorous acid (HOCl), an EPA-registered, hospital-grade disinfectant. This atomization (fogging) system has been proven highly effective in pathogen reduction as demonstrated by rigorous independent laboratory testing required for efficacy validation to achieve EPA registration.

Some hospitals are investigating whole-room disinfection robots that promise disinfection using ultraviolet (UV) light. Though there are many such products in the market, their common operation method involves the emission of ultraviolet radiation typically centered around 254 nm wavelength which falls in the germicidal band of the UV spectrum known as UV-C or UVC. While UVC is known to kill pathogens, the practical efficacy of whole-room UVC robots are limited by distance and line of sight. Furthermore, UVC is not subject to EPA efficacy testing requirements. Industry literature demonstrates conflicting information regarding effectiveness in combating HAI sources.

Nevoa Inc. contracted the University of Arizona College of Public Health to test the effectiveness of a well-known, latest generation UVC robot using EPA-mandated methodology in a simulated hospital room environment, so that comparative conclusions can be drawn about the efficacy of UVC versus whole room fogging technology.

METHOD

To measure disinfection efficacy using a standardized approach, the University of Arizona College of Public Health employed AOAC 961.02 test methods that are also used by the Environmental Protection Agency (EPA) for evaluating bactericidal efficacy. In the study, scientists furnished a 14 x 14.5' x 8.4' (1705 ft3) room with hospital room furnishings including hospital bed, bedside table, mobile medical cart, IV pole, and other medical equipment typically found in an acute care patient room. In this controlled space, ten (10) ceramic test carriers were deployed onto predetermined horizontal and vertical surfaces after having been inoculated with Staphylococcus aureus (ATCC # 6538); additional carriers were likewise prepared as test controls. The S. aureus carriers were placed primarily in locations that were directly in the UVC tower line of sight, with three (3) carrier sites in locations shadowed from the UVC tower. The UVC tower was prepositioned in the middle of the room near the foot of the patient bed and operated in accordance with manufacturer's instructions using the "Bacteria – Full Cycle SmartUVC" setting which allows the UVC system to optimize the dosage required in the space based upon embedded technology. The automatic disinfection cycle was completed in approximately 17 minutes. Following the disinfection intervention, test samples were harvested, plated, incubated, and measured for any surviving S. aureus bacterial colony forming units (CFUs). Test sample CFU counts were then used to calculate disinfection efficacy as bacterial LOG reduction from unexposed control samples.

Similarly, Nevoa's Nimbus whole-room disinfection robot using HOCL Fog, was tested by an independent laboratory using EPA mandated protocols. During Nimbus testing, furnishings were placed in the same size simulated hospital room environment. Test carriers were inoculated with S. aureus; and deployed onto predetermined surfaces. Nimbus was prepositioned in the middle of the room and operated in accordance with manufacturer's instructions. Nimbus efficacy against S. aureus 6538 verified during testing is presented as a comparison to the UVC disinfection efficacy measured during this University study.

RESULTS

The UVC tower achieved a mean disinfection efficacy of Log Reduction = 1.02, which means the UVC system killed an average of 90.45% of S. aureus bacteria across all test carriers. The maximum Log Reduction = 2.60 and minimum Log Reduction = 0.34, with a standard deviation of 0.80. For five (5) surfaces that were within six (6) feet of the UVC tower and in direct line-of-sight, the maximum, mean, and minimum Log Reduction values were 2.60, 1.32, and 0.41, respectively. The remaining five (5) surfaces were either obscured (shadowed) or farther than six (6) feet from the UVC tower and achieved maximum, mean, and minimum Log Reduction values of 1.14, 0.72, and 0.34, respectively.

The EPA-registered Nevoa Nimbus system atomizing Nevoa Microburst Solution™ [EPA reg. no. 90880-1] demonstrates whole-room disinfection when tested against S. aureus with a mean LOG reduction of 6.77. Maximum Log Reduction = 6.87 and minimum Log Reduction = 6.58, with a standard deviation of 0.10.

Figure 1 above illustrates the relative performance between UVC and Nimbus disinfection efficacy across sample sites along with the Log 4 minimum performance standard required to achieve EPA registration as a disinfectant.

CONCLUSION

By comparison, the typical UVC disinfection efficacy is vastly lower than the whole room HOCL fogging technology for a variety of factors including dramatically reduced effectiveness as a function of distance from the UVC radiation source and shadowing. Hospitals choosing the whole room HOCL fogging technology instead of UVC technology can expect substantially improved disinfection outcomes and assured levels of disinfection as regulated by the EPA for qualification of a Hospital Grade Disinfection.