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ULTRAVIOLET LIGHT EFFICACY FOR DECONTAMINATION OF SAFETY GLASSES

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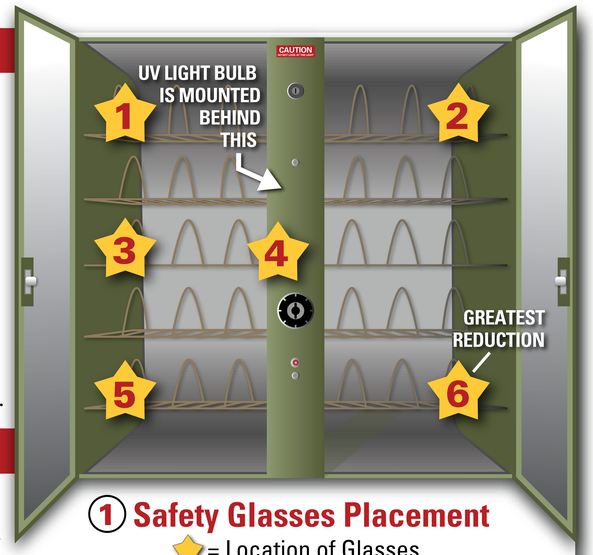
INTRODUCTION

Personal protective equipment, such as eye protection, may serve as a fomite of pathogenic microorganisms in academic workplaces, especially laboratory spaces. Costs associated with providing eye protection can result in the re-use of safety glasses, leading to lateral transmission of pathogens between individuals.

In this study, the efficacy of an ultraviolet (UV) light cabinet was investigated for disinfecting plastic safety glasses artificially contaminated with *Staphylococcus aureus*.



① Safety Glasses Placement
★ = Location of Glasses

METHODS

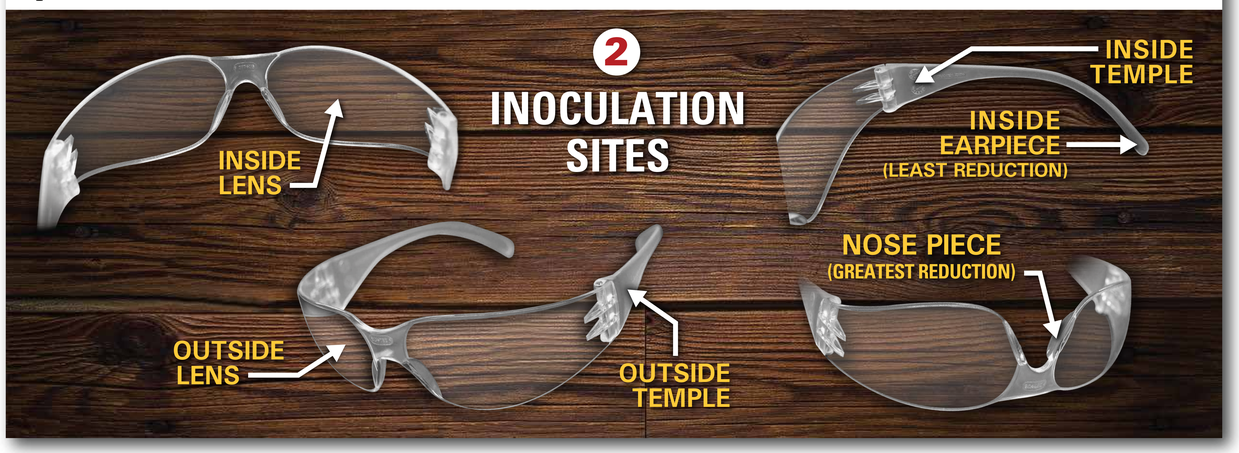
UV Disinfection Cabinet: The cabinet (Diagram ①) is 30 x 30 x 12 inches with a single 15-watt fluorescent UVC (wavelength: 254 nm) tube mounted vertically inside the center-front. Each shelf can hold 8 pairs of safety glasses. The cabinet has two front-opening top-to-bottom doors and a lock to prevent opening during the 15 minute decontamination cycle. If the lock is bypassed and the doors are opened during a cycle, a kill switch stops operation of the cabinet.

Preparation of Inoculum: *S. aureus* (ATCC 29213) was grown on trypticase soy agar (TSA) plates for 24 hours at 37 °C. Colonies were transferred to 50 ml volumes of trypticase soy broth and incubated overnight at 37 °C.

S. aureus broth cultures were centrifuged and the resulting pellet re-suspended in 10 mL buffered peptone water.

Inoculation: Six sites (Diagram ②) on six pairs of safety glasses were inoculated by dipping a sterile cotton swab into the harvested culture and wiping the inoculum onto pre-drawn circles on the glasses.

An additional pair of safety glasses was inoculated and not subjected to UV treatment to serve as a positive control.



METHODS CONTINUED

Enumeration: After treatment, one sterile cotton swab, moistened in buffered peptone water, was scrubbed on a single inoculated area and placed in a sterile tube containing peptone water. Enumeration of bacteria was done by serial dilution and direct plating on TSA and Baird-Parker agar. Plates were incubated at 37 °C for 24 hours before the colonies were counted.

The data was analyzed using @RISK® software package, a Microsoft Excel plugin package that performs risk analyses utilizing Monte Carlo simulation.

RESULTS

No significant difference between the following ($P > 0.05$):

- Non-selective (TSA) vs. selective agar (Baird-Parker agar)
- Populations of bacteria from any of the inoculated sites
- Location of the glasses within the cabinet

Significant difference ($P<0.001$) between the number of organisms on UV treated vs. control glasses. Net reduction of organisms = $\log_{10}$ 2.2/cm^2.

Group	# of Sites	# of Organisms ($\log_{10}$/cm^2)
Treated Glasses	144	4.549
Control	24	6.813

Significant interaction ($P < 0.05$) between location of the glasses in the cabinet and inoculation site on the glasses.

> Greatest reductions were on the nosepiece of the glasses at location ★6 in the cabinet. The least reduction was on the inside ear piece at location ★5 in the cabinet.

Source of Variation	Degrees of Freedom	P Value
Site inoculated on glasses	5	0.318
Location of glasses in cabinet	5	0.013
Site inoculated X Location	25	0.042

DISCUSSION

The effectiveness of disinfection utilizing UV light is dependent on direct exposure of UV light to the surfaces where the microorganisms reside. Our data shows that the location of the glasses within the cabinet does not have a significant effect on bacterial inactivation. There is also no significant effect between the sites that were inoculated. In this cabinet, reflective surfaces are used to ensure line-of-sight exposure of all contaminated glass surfaces to UV light. When used properly, this cabinet is capable of reducing bacterial contamination below the infective dose.

ACKNOWLEDGEMENTS

The authors wish to acknowledge Dr. James Dickson's laboratory staff for performing the bacteriology for this project.

REFERENCES

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