PROTECTING OUR HEROES : Decontamination Protocol for POLICE VEHICLES During COVID-19 Pandemic

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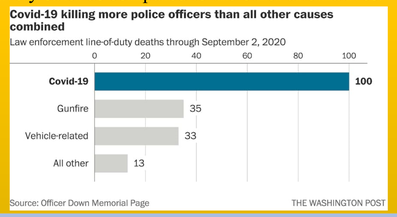
Abstract

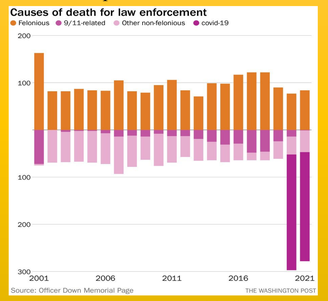
COVID-19 pandemic has emerged as the greatest public health threat of the 21st century. Although this pandemic has adversely affected the world population, the worst hit group has been the first responders. SARS-CoV-2 virus the causative agent of COVID-19 disease primarily get transmitted by droplet and aerosol, however in some cases fomites have also been suspected to cause the transmission. As Merced is a developing town, the availability of essential facilities are less than optimal. At some time during the pandemic, the public safety vehicle was the only option for transporting COVID positive students to and from patient care or hospitals. The goal of this study was to use a simple inexpensive, and effective quantitative method of decontamination that can be used for any first responder and/or non-emergency vehicle. We applied hydrogen peroxide vapor to decontaminate the inner surfaces of police vehicles for the purpose of decontamination after transporting passengers infected with SARS-CoV-2. The objective of this study was to test the efficacy of a hydrogen peroxide vapor generator unit which is not primarily designed for the passenger vehicle. In an hour-long operation, the hydrogen peroxide level inside the vehicle raised to 75 g/m3. Multiple chemical and biological indicator strips were strategically placed in the vehicle to determine the optimum level of hydrogen peroxide vapor to the farthest corners. During the operation, a six-log cycle reduction in bioburden was achieved which was confirmed by the chemical indicators. In conclusion, the successful completion of this decontamination study provided additional ammunition in our toolkit in the war against the infectious COVID-19 disease.

Introduction

Frontline workers include public safety and first responders who sacrifice their own safeguard to serve for the welfare of humankind, across the world. While we religiously practiced social distancing and followed stay-at-home orders, many essential workers were performing active duty in the time of pandemic.

VHP hydrogen peroxide vapor has been widely used for the decontamination of confined spaces for e.g., rooms, isolator, building spaces and etc. The application of hydrogen peroxide vapor is comparatively safer as compared to the other alternatives.





Objectives

a) to standardize the procedure of decontaminating the public safety vehicle that are used for PUI/COVID-19 asymptomatic patient transportation

b) to test the efficiency of vaporized hydrogen peroxide to decontaminate small to medium scale automobiles

Materials and Methods

1. The Bioquell BQ-50 unit was placed inside the vehicle on a custom-made platform
2. Multiple biological and chemical indicator strips were placed inside the vehicle
3. All vents and windows of the vehicle were thoroughly taped off using PVC gas impermeable tape
4. The BQ-50 unit was remotely operated by an outside console
5. After the operation, the vehicle was opened, and biological indicator strips were carefully placed in TSB media. The media was incubated in a high temperature (58°C) incubator

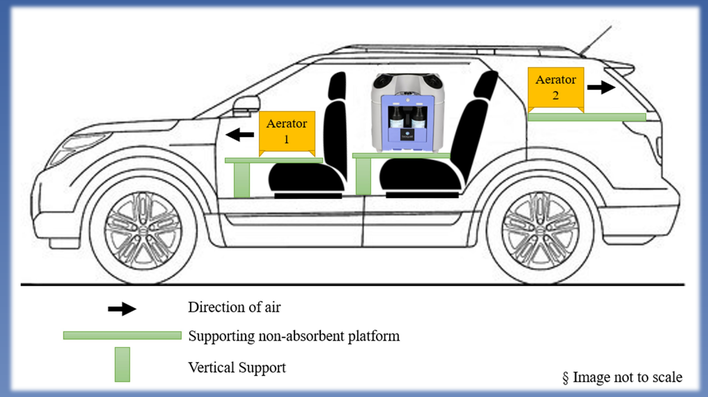


Fig. 1: Schematic diagram of Bioquell set up in public safety vehicle

Results and Discussion

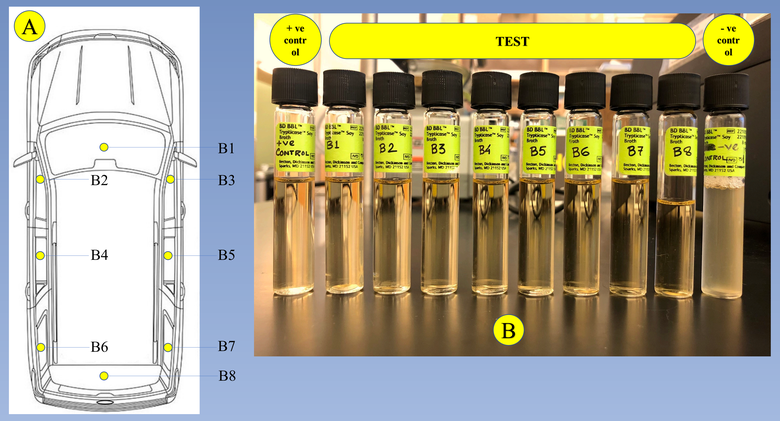


Fig. 2: Positions of biological indicator strips inside the PD vehicle (A), and results biological indicator strips (B), including positive control, test (B1-B8), and negative control

Hydrogen peroxide exposed Biological Indicators (BIs) containing spores of *Geobacillus stearothermophilus* were incubated in TSB media. After seven days of incubation period at 58°C, the test media tubes (B1-B8) exhibited no growth. The negative control showed microbial growth within 24 hours, and positive control remained unchanged as it was not inoculated with any indicator strain.

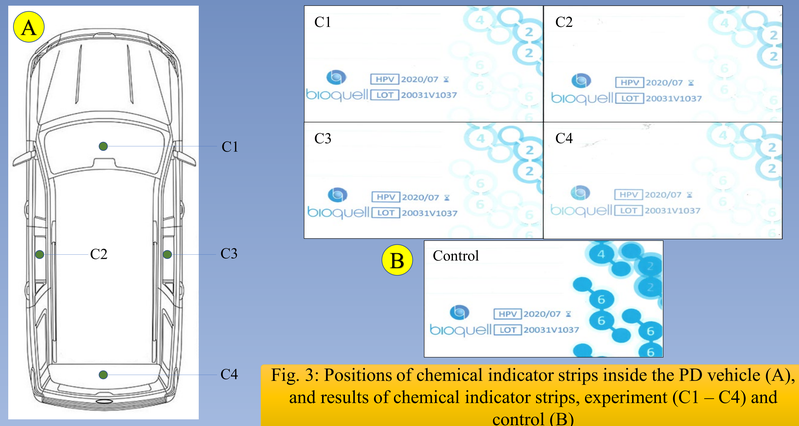


Fig. 3: Positions of chemical indicator strips inside the PD vehicle (A), and results of chemical indicator strips, experiment (C1 – C4) and control (B)

Chemical indicator strips (C1 – C4) showed extensive discoloration circles confirming the presence of optimal concentration of H_2O_2 required for 6 log cycle reduction of microorganisms. The strip at the bottom represents the control that was not exposed to H_2O_2. The outer circle and the numbers represent the reference color and the number of log cycle respectively. The inner circle contains the reactive ink which fades due to the presence of H_2O_2. The number of log cycle is determined when the color of the inner circle matches the reference color

Conclusion

1. This method was proven to be easy, successful, and cost-effective can be adapted for any emergency or non-emergency transport vehicles, including but not limited to school shuttles
2. The method is quantitative and effective as shown by both the biological and chemical indicator results

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