PROTECTION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL PROTECTION

A Miniaturized Electrostatic Precipitator Respirator Effectively Removes Ambient Sars-cov-2 Bioaerosols

Chad Roy Tulane University School of Medicine **Rachel Redmann** Tulane National Primate Research Center **Brandon Beddingfield** Tulane National Primate Research Center **Skye Spencer** Tulane National Primate Research Center **Nicole Chriichella** Tulane National Primate Research Center **Julian Henley** Henley Ion **Wes Hager** Phase 3 Development

Background information: The inhalation of ambient SARS-CoV-2-containing bioaerosols leads to infection and pandemic airborne transmission in susceptible populations. Filter-based respirators effectively reduce exposure but complicate normal respiration through breathing zone pressure differentials; therefore, they are impractical for long-term use.

Objectives: We tested the comparative effectiveness of a prototyped miniaturized electrostatic precipitator (mEP) on a filter-based respirator (N95) via the removal of viral bioaerosols from a simulated, inspired air stream. Methods: Each respirator was tested within a 16 L environmental chamber housed within a Class III biological safety cabinet within biosafety level 3 containment. SARS-CoV-2-containing bioaerosols were generated in the chamber, drawn by a vacuum through each respirator, and physical particle removal and viral genomic RNA were measured distal to the breathing zone of each device.

Measurements and main results: The mEP respirator removed particles (96.5 ± 0.4%), approximating efficiencies of the N95 (96.9 ± 0.6%). The mEP respirator similarly decreased SARS-CoV-2 viral RNA (99.792%) when compared to N95 removal (99.942%), as a function of particle removal from the airstream distal to the breathing zone of each respirator.

Conclusions: The mEP respirator approximated the performance of a filter-based N95 respirator for particle removal and viral RNA as a constituent of the SARS-CoV-2 bioaerosols generated for this evaluation. In practice, the mEP respirator could provide equivalent protection from ambient infectious bioaerosols as the N95 respirator without undue pressure drop to the wearer, thereby facilitating its long-term use in an unobstructed breathing configuration.

Impact to DTRA and the warfighter: Augment existing personal respiratory protection, next generation filterless respiratory protection; active monitoring of real-time respiratory exposure

Funding: This study was supported, in part, by Henley Ion, Inc. and also supported, in part, by Grant OD011104 from the Office of Research Infrastructure Programs, Office of the Director, NIH.
Viruses 2022 Apr 6;14(4):765. doi: 10.3390/v14040765.
PMID: 35458496 PMCID: PMC9025737 DOI: 10.3390/v14040765