Wearable Air Curtains as Advanced Personal Respiratory Protection

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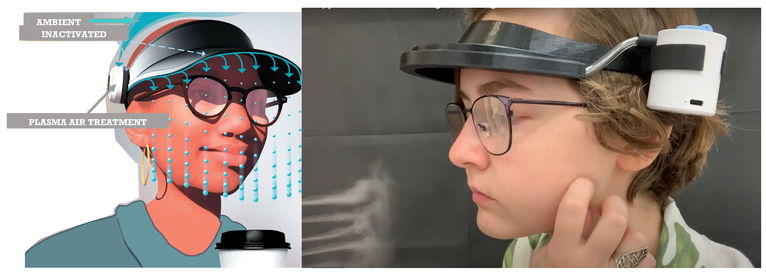
Introduction

- Conventional face masks are often cited based on their filtration, not their in-use, performance. Infiltration around a filtering mask results in much lower in-use performance.
- Congregant work settings such as meat and poultry processing continue to be high risk environments for airborne infectious disease transmission, according to a recent GAO report[1].
- Individuals at high risk of severe COVID-19 continue to wear masks and proactively protect themselves, in the absence of mask mandates. However, masks cannot be worn while eating or drinking, and they interfere with oral and non-verbal communication.

Objective

- Parametrically measure the performance of a wearable air curtain visor.



Experimental Methods

- Ultrasonic medical nebulizer (fluid: water)
- 3X particle counters (Extech)
- 3DP visor, supplied with compressed air
- Custom-built test chamber

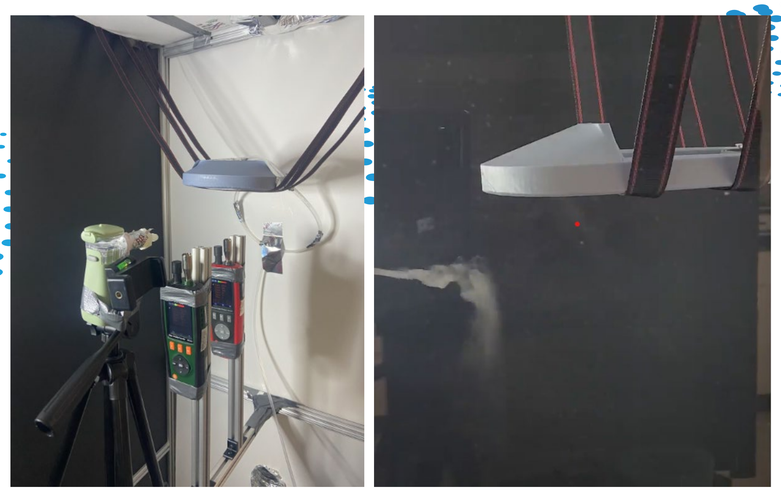


Fig. 1 (L) Photo of experimental setup. (R) Photo of air curtain visor being challenged by mist from medical nebulizer.

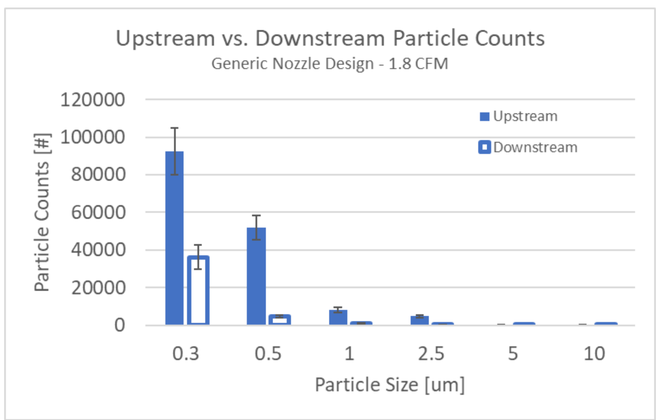


Fig. 2 Mean and SD particle counts by particle size, upstream vs. downstream of generic air curtain nozzle array.

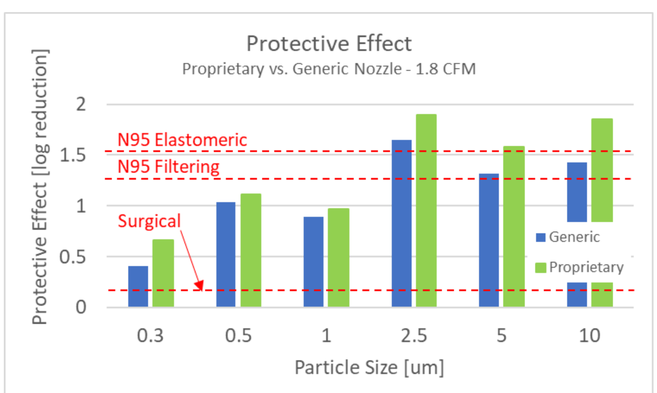


Fig. 3 Log-reduction in particle counts by particle size, generic vs. proprietary air curtain nozzle array designs.

Key Findings and Implications

- Measured protective effect of both generic and proprietary nozzle designs was comparable to N95 masks (95-97%), and exceeded by a wide margin the performance of surgical masks (40%)[5]
- Enhanced performance of a proprietary nozzle design was confirmed
- In actual operation, the visor air flow would be ambient air disinfected via treatment in a non-thermal plasma (NTP). NTPs can achieve equivalent levels of viral disinfection (~98%) as UV and HEPA filtration, with the advantage of processing 3X-4X higher air flow rates,at 25% lower pressure drop (than HEPA), within a platform that is up to 44X smaller than HEPA or UV[2-4].

Acknowledgements

This work is funded through the Meat and Poultry Processing Research Initiative (MPPRI) of the USDA National Institute of Food and Agriculture (Grant # #2023-70439-39198). Additional funding supporting this work was provided by Johnson & Johnson Innovation (JLabs) and the Biomedical Advanced Research and Development Authority (BARDA). SJS and ELP gratefully acknowledge partial funding through the Michigan Economic Development Corporation STEM FORWARD program. The authors also express their gratitude for the foundational work of Erin Schimmel, Doug Herron and Dr. Yao Kovich.

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