Title: Revolutionizing PPE with highly integrated miniature Far UV-C modules

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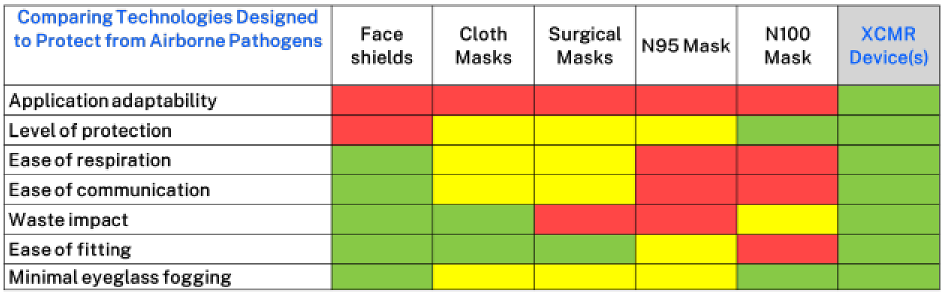
Body

Objective. The COVID-19 pandemic caused by SARS-CoV-2 exposed weaknesses in society's ability to rapidly respond to a global public health crisis. While vaccines and therapeutics can be very effective, they require substantial development and testing and do not address the need for immediate personal protection. Personal protective equipment (PPE), e.g., masks, gloves and goggles, filled that gap but faced significant challenges including supply chain issues and public reluctance. XCMR is developing a novel form of PPE that integrates Far UV-C (222 nm) into a safe, battery powered, wearable device to provide an individual with a continuous "invisible" bubble of clean air during respiration. This shorter wavelength offers effective microbial disinfection typically associated with conventional germicidal UVC lamps (254 nm) but without the corresponding human health hazards since it does not penetrate the human skin or outer tear layers of the eye. ***Methods.*** XCMR has partnered with Eden Park Illumination to evaluate how their miniaturized Far UV-C (222 nm) microplasma technology can be incorporated into various configurations to test its ability to inactivate microbes during simulations of aerosolized respiratory droplets. Additional sources of Far UV-C (222 nm) with increased irradiance or lower power requirements are also being examined. Comprehensive irradiance measurements of Far UV-C (222 nm) were conducted using calibrated radiometers and irradiance micro-probes. Inactivation of a virus surrogate (T1 phage) within the irradiance fields was measured to validate models of inactivation. An important aspect of our approach involves the inclusion of materials that are highly reflective of Far UV-C radiation. These new reflective films are thin and pliable, allowing them to conform to essentially any shape. As such, they offer the possibility of altering the spatial distribution of radiant energy within the irradiated zone of a Far UV-C based system, while also increasing the efficiency of use of photon energy from these sources. ***Results***. We achieved a 1.6 log reduction (97.5% inactivation) of the T1 phage with 2 mJ/cm^2 dosage which translates to an expected a reduction of ~2.8 (99-99.8%) for SARS-CoV2 when the UV sources were positioned in a geometry to mimic the wearable device. ***Conclusions***. Our data demonstrate the feasibility that Far UV-C (222 nm) can be incorporated into a wearable, reusable device to inactivate airborne pathogens and achieve the equivalent protection as an N95 mask without interfering with visible facial cues. More importantly, by inactivating the pathogen rather than just filtering it, we create cleaner air beyond the personal space of the wearer. Furthermore, XCMR's PPE device mitigates the biohazard waste from such disposable masks. In summary, the team at XCMR has developed a novel, next generation PPE device that offers significant advantages in combating airborne pathogens over current PPE.

See below:


Comparing Technologies Designed to Protect from Airborne Pathogens
Face shields
Cloth Masks
Surgical Masks
N95 Mask
N100 Mask
XCMR Device(s)
Application adaptability
Level of protection
Ease of respiration
Ease of communication
Waste impact
Ease of fitting
Minimal eyeglass fogging