Testing Fabric and Mask Particle Filtration Efficacy

Lau, Logan (School: Kamehameha Schools Kapalama Campus)

Since the rise of the SARS-CoV-2 pandemic, face masks have been widely accredited with decreasing the transmission of aerosol and respiratory droplets and slowing the spread of the virus. This has caused demand for surgical masks like the N95 to skyrocket and a plethora of homemade mask options to enter the marketplace. This project focuses on two main elements; first, testing a variety of surgical, homemade, and unique masks and fabrics in order to determine which mask/fabric provides the greatest particle filtration efficacy, and second, proposing which mask or fabric is best suited to address the nation's N95 shortage. Each mask/fabric was grouped into categories which were common homemade, surgical, and unique. Two different spray bottles were used; one sprayed a fine mist imitating aerosols, while the other sprayed larger particulates imitating respiratory droplets. Utilizing a 3.0 M NaCl solution, enclosure, array of microscope slides, microscope, and Bio7, each mask/fabric was sprayed, photographed, and analyzed three times with each bottle. A separate experiment was also conducted using a 532nm wavelength, 0.2W, 12V, wide-beam green laser, a VIS 0 coated, negative planoconcave, cylindrical lens, and human coughs. It was found that most face masks, excluding the neck gaiter, blocked and filtered more than 90% of particulates. It was also found that the double-layer cotton mask and the 250 thread-count bedsheet masks provided the greatest filtration efficacy of the homemade category while surgical masks like the N95 had filtered virtually 100% of particulates. Moreover, steri wrap and kapa fabric were identified to be the most capable, eco-friendly N95 substitutes, as a single layer of either fabric boasted a nearly identical filtration efficacy to a 3-ply N95.

Awards Won: