Nature Breathe: Natural Plant Material HVAC Filter for Nanoparticle Filtration

Varos, Benjamin (School: Taos Academy Charter School)

In 2020, our world entered a new normal that includes virtual school, mask wearing and voluntary quarantines. The reason? SARS-Cov-2: COVID-19. To go back to ‘in-person’ safely, precautions and steps have to be taken, including the upgrade of Heating, Ventilation, & Air Conditioning (HVAC) for proper ventilation. Traditional HVAC systems intake air through a filter and circulate it out through vents. Traditional filters are made of synthetic materials that have to be burned every two weeks for proper disposal, increasing carbon emissions. Nature Breathe is a low-cost natural plant-based filter for HVAC systems, with the equivalent of MERV-13 and higher particulate filtering and cohesion under pressure. This filter will attract and trap nanoparticles representative of viruses to reduce airborne and aerosol transmission. Fibrous tight weaves with natural binding agents will be more efficient. 10cm2 filters were produced by pulping the plants (cotton, mullein, pine, cottonwood, Siberian Elm bark, desert aloe vera rubber/pulp, rabbitbrush) with and without binders (corn starch, Siberian elm syrup, aloe vera) and drying them in silicon molds. Their cohesion out of the molds and particulate absorption or penetration were tested using a LASER diffraction wall and fluorescent glucose copper nanoparticle (GluCuNP) adhesion under a microscope. Siberian elm, rabbit brush, cotton, and aloe vera rubber with both aloe vera and Siberian elm binders were highly effective at reducing particle penetration, and at trapping the particles in its fibers, and were 80% more efficient at absorbing nanoparticles than the MERV-13 filter.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category