Filtration and Purification Nanofiber Technologies for Combating Novel Coronavirus Outbreak

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Recent outbreak of Novel Coronavirus, referred to as 2019-NCoV, causes a worldwide concern on possible extensive epidemic outbreak around communities in the world. W.H.O. has already declared on January 30, 2020 the new coronavirus outbreak as a global health emergency.

The virus can be spread through human-to-human by droplet and airborne particles. The spread through saliva droplet can be prevented more easily as the droplet size can be relatively large in comparison to airborne particles. However, airborne spread may be more extensive. According to Chinese Center for Disease Control and Prevention, the virus size is about 100nm. When airborne the virus can be attached to nuclei particle which can be large or small. Regardless, the minimum size of airborne NCoV is still about 100nm. This size is referred to as nanoaerosol (known also as nanoparticle or ultrafine particle). While NIOSH has standardized N95 and N98 at 300nm, there is no standard filtration test for nanoaerosols at 100nm or even smaller. There is also little published on filtration of nanoaerosols as well.

In the past 15 years, our group have dedicated our research work to filter airborne nanoaerosols as they are present in abundance by number concentration in pollutants and also in airborne viruses, from common flu to SARS, MERS, swine flu, bird flu and the most recent NCoV that has infected over 10,000 and killed over 260 people by the end of January 2020 with the death toll keeps growing exponentially. Nanofiber filters, by virtue of the small diameter of the fibers, typically 100-300nm, have large specific surface that are most suitable to capture by diffusion these nanoaerosols that can penetrate deeply into our lung causing infection, sickness and even death.

From basic research to commercial realization, multilayer nanofiber technology has been developed 1 WFC 13 to achieve high filtration efficiency while maintaining low pressure drop. It is most suitable for personal protection such as face mask. Not only the technology has been tested extensively in laboratory using sodium chloride aerosols, 50-500nm, but has been ‘road-tested’ on real aerosols, 10- 400nm in size,

from traffic emission with high concentration of nanoaerosols concentrated around 100nm, which is also the same size as NCoV. In addition, for long-term filtration in plane/train/vehicle cabins, the composite nanofiber technology has been developed to provide filters with high capacity, high efficiency and low pressure drop.