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S1.6: Microstructure Change of Masks and Respirators During Loud Talking, Coughing and Sneezing

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ABSTRACT

The wearing of masks has been recommended as one of the primary means to prevent infectious SARS-CoV-2 from the spreading in the poorly-vented indoor environments and the dense-populated communities as well as for the public during the current COVID-19 pandemic. N95 respirators (for healthcare workers) and surgical/procedure masks (for the public) have been recommended by the US CDC and WHO as the personal protection equipment (PPE). Additional to applying as a barrier stopping the virus transmission, a mask/respirator worn by an infected person is to contain the virus-loaded droplets produced during the normal breathing, talking, coughing and sneezing by filtration. It has been evidenced that millions of SARS-CoV-2 particles per hours were exhaled by the COVID-19 patients in early stages. The peak velocity in a normal breathing of an adult (in a tidal profile) is ~1.3 m/s. The current standards to certify the filtration performance of masks/respirators are however designed under a constant flowrate, i.e., 85 LPM (linter per minute) in US and 95 LPM in Europe, resulting in the face velocity of 0.05~0.1 m/s for a typical mask/respirator (depending on the filtration area used in the mask/respirator design). The air velocity exhaled from an adult could even reach ~5 and ~50 m/s during the coughing and sneezing, respectively. Additional to high velocity, an air flow expelled under the loud talking, coughing, and sneezing is short-pulsed (~0.1-0.3s). The potential of the media microstructure change and outward particle leakage due to the impingement of a short-pulsed high velocity flow on mask media is thus increased.