Filtration Performance of LOG3Mask - Pleated

Report prepared by Weixing Hao and Yang Wang, Missouri S&T

Introduction: The filtration performance of facemasks mainly includes filtration efficiency and flow resistance (breathability). This report summarized the aerosol size-dependent (30 nm – 5000 nm) filtration efficiency of the LOG3Mask - Pleated from Claros Technologies Inc at three different face velocities of 9.2, 15.3, 23.2 cm s^{-1}. The flow resistance across the filter material was measured as an indicator of the breathability of the material. The filtration performances of the LOG3Mask - Pleated material were also compared against surgical earloop facemask materials. The tests were conducted on 12/21/2020.

Experiment: The filter material was cut to a disc with a diameter of 37 mm and firmly pressed onto mesh support, and sealed at the edge. The sample and experimental setup are shown in Fig. 1. and Fig. 2.

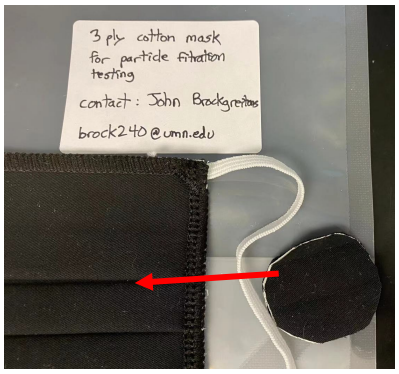

Fig. 1. LOG3Mask – Pleated material

Results: Figs. 3-5. display the size-dependent filtration efficiencies of one layer LOG3Mask - Pleated material and also shows the comparison against the surgical facemask materials under the face velocity of 23.2, 15.3, 9.2 cm s^{-1}.

Discussion: The filtration performances of LOG3Mask - Pleated material are examined under three face velocities of 23.2, 15.3, 9.2 cm s^{-1}. At an inhaling flow rate of 60 lpm, the face velocities correspond to filtering areas of 43, 67, and 111 cm^2, respectively.

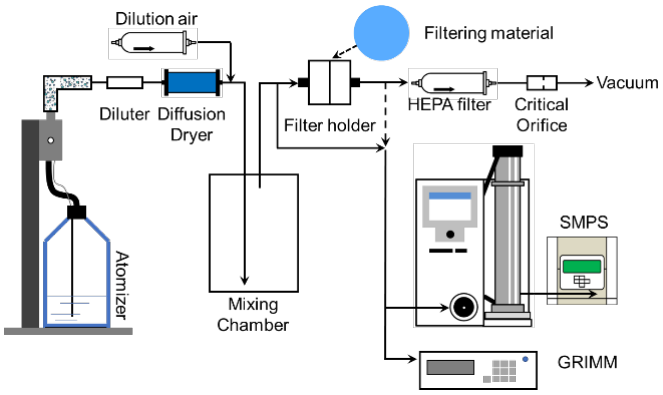

Fig. 2. The experimental setup.

The filtration efficiency of the LOG3Mask is higher than that of the surgical mask for particle sizes above 200 nm at the face velocities of 23.2 and 15.3 cm s^{-1} (Figs. 3-4). At the face velocity of 9.2 cm s^{-1}, the filtration efficiency of the LOG3Mask and surgical mask are equal for particle sizes above 500 nm (Fig. 5). For particle sizes below 200 nm, the filtration efficiency of the LOG3Mask is lower than that of the surgical mask. By contrast, the filtration efficiency is similar when particle sizes are from 500 nm to 5000 nm, which shows a significant increase in this size range compared to the relatively smaller size range. As for one layer LOG3Mask - Pleated material, the results show that the enhanced face velocity led to increased filtration efficiency for particles with larger sizes (e.g., above 200 nm). The removal of larger particles likely benefited from the enhanced velocity, promoting the impaction and interception of particles on the materials. Regarding particles with smaller sizes, it is likely that particle residence time is not long enough for particle collection via Brownian motion under the enhanced velocity.

The flow resistance shows a higher pressure drop with 0.18 ± 0.03 kPa, compared to 0.09 ± 0.02 kPa for surgical mask materials with the face velocity of 9.2 cm s^{-1}. The flow resistance is increased at higher face velocities, which are 0.45 ± 0.07 and 1.08 ± 0.11 kPa under the face velocities of 15.3 and 23.2 cm s^{-1}, compared to 0.21 ± 0.02 and 0.43 ± 0.03 kPa for surgical mask materials.

Besides, the tested material and surgical mask materials show an “escape window.” It is also known as the most penetrating particle sizes (MPPS), where particles with hundreds of nanometers can penetrate through the filter, resulting in lower efficiencies between 100 and 500 nm. It is a common phenomenon for filter materials due to the combined filtration

mechanisms of Brownian diffusion, interception, and impaction.

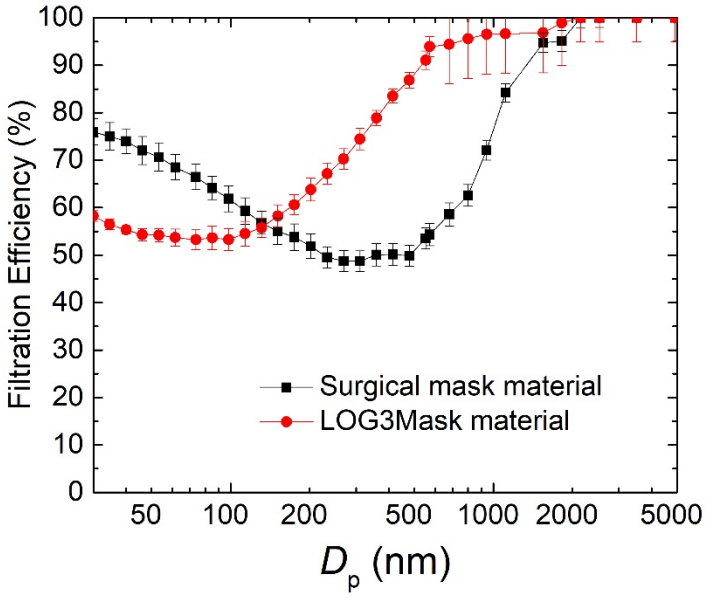

Fig. 3. Size-dependent filtration efficiency of LOG3Mask - Pleated material and surgical mask materials under the face velocity of 23.2 cm s^{-1}.

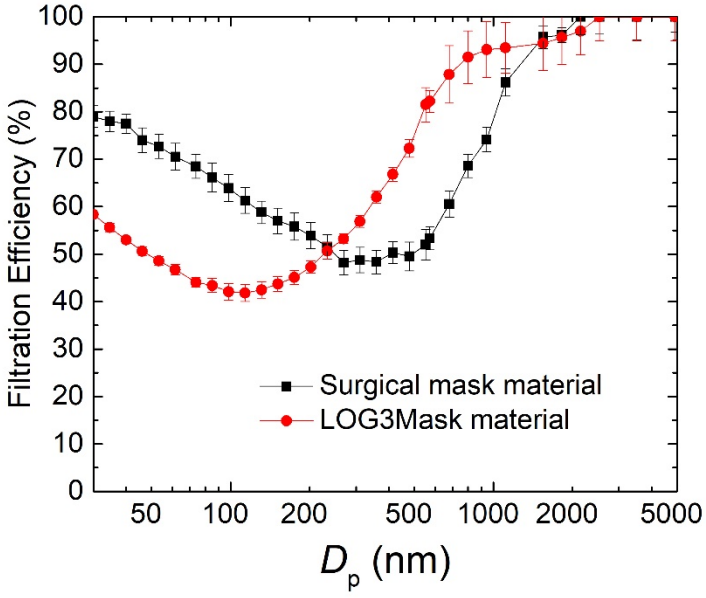

Fig. 4. Size-dependent filtration efficiency of LOG3Mask - Pleated material and surgical mask materials under the face velocity of 15.3 cm s^{-1}.

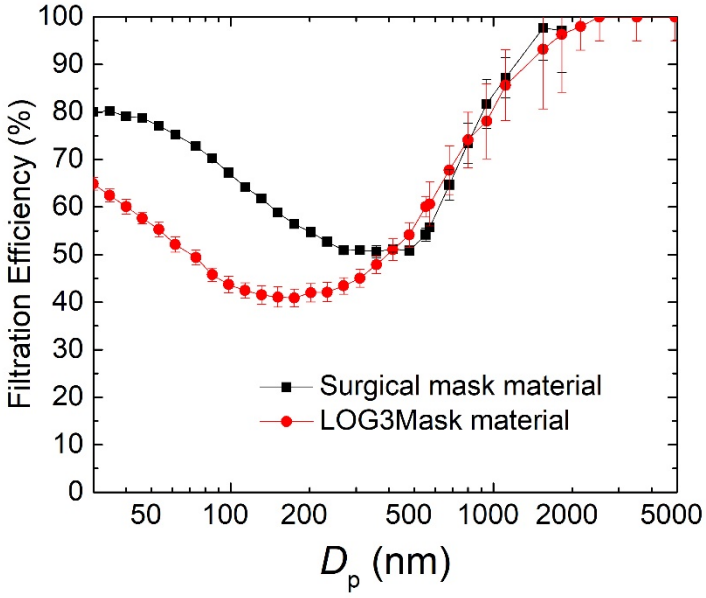

Fig. 5. Size-dependent filtration efficiency of LOG3Mask - Pleated material and surgical mask materials under the face velocity of 9.2 cm s^{-1}.

Report prepared by

Yang Wang
Assistant Professor
Particle Measurement and Technology Laboratory
Civil, Architectural and Environmental Engineering
Missouri University of Science and Technology
Rolla, Missouri, USA

Weixing Hao
Ph.D. Student
Particle Measurement and Technology Laboratory
Civil, Architectural and Environmental Engineering
Missouri University of Science and Technology
Rolla, Missouri, USA