Supplementary Appendix

A letter to reconsider the conditions for testing decontaminated N95 respirators for emergency reuse to address shortage

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Equations used in calculating efficiency as a function of face velocity

Note: We considered ambient conditions during calculations.

We calculated the single-fiber efficiency, $E_\Sigma$, by summing the individual efficiencies from diffusion, $E_D$, interception, $E_R$, and inertial impaction, $E_I$:

$$E_\Sigma = E_D + E_R + E_I \quad (\text{Eq. 1})$$

$$E_T = 1 - e\left(-\frac{4E_\Sigma \alpha L}{\pi d_f}\right) \quad (\text{Eq. 2})$$

where $E_T$ is the total efficiency of a filter composed of many fibers in a mat, $\alpha$ is the solidity or packing density of the filter, $L$ is the filter thickness, and $d_f$ is a fiber of diameter.

$$Pe = \frac{d_f U}{D} \quad (\text{Eq. 3})$$

where $Pe$ is the Péclet number, $U$ is the face velocity at the filter surface, and $D$ is the diffusion coefficient of the particle.

$$D = \frac{kT c_e}{3 \pi \eta d_p} \quad (\text{Eq. 4})$$

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in which \( k \) is the Boltzmann constant, \( T \) is the absolute temperature, \( \eta \) is the air viscosity, \( d_p \) is the particle diameter, and \( C_c \) is the Cunningham slip correction.

\[
C_c = 1 + \frac{\lambda}{d_p} \left[ 2.33 + 0.966e^{-0.499\frac{d_p}{\lambda}} \right] \quad \text{(Eq. 5)}
\]

where \( \lambda \) is the mean free path of the gas molecules.

\[
E_D = 2.9 \, Ku^{-1/3} \, Pe^{-2/3} \quad \text{(Eq. 6)}
\]

\( Ku \) is the hydrodynamic factor, or Kuwabara number:

\[
Ku = -0.5\ln\alpha - 0.75 + \alpha - 0.25\alpha \quad \text{(Eq. 7)}
\]

\[
E_R = \frac{1+R}{2Ku} \left[ 2\ln(1+R) - 1 + \alpha + \left( \frac{1}{1+R} \right)^2 \times \left( 1 - \frac{\alpha}{2} \right) - \frac{\alpha}{2} (1+R)^2 \right] \quad \text{(Eq. 8)}
\]

in which \( R \) is the interception effect:

\[
R = \frac{d_p}{d_f} \quad \text{(Eq. 9)}
\]

The dimensionless Stokes number, \( Stk \), is:

\[
Stk = \frac{\rho_p d_p^2 C_c U}{18 \eta d_f} \quad \text{(Eq. 10)}
\]

where \( \rho_p \) is the density of the particle.

\[
E_I = \frac{Stk}{(2\,Ku)^2} [(29.6 - 28\alpha^{0.62})R^2 - 27.5R^{2.8}] \quad \text{(Eq. 11)}
\]