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Physical properties, inhalation and deposition of e-cigarette aerosols

Abstract *

Dose from aerosol exposure is determined by the site and magnitude of deposition in the airways, and aerosol droplet diameter and concentration may influence this. Cigarette smoke and e-cigarette aerosol are both sub-micron condensation aerosols and typically can achieve concentrations of up to $1e9 \text{ cm}^{-3}$. Size measurement has been conducted typically by electrical mobility, laser diffraction and impaction-type methods. Cigarette smoke aerosols are typically smaller in the range of 150-250 nm mass median diameter (MMD), depending on design, particularly filter ventilation, which influences coagulation time. E-cigarette aerosol droplets modelled here are 400-600 nm MMD as typically seen from cartomizer style devices. The principal factors controlling growth and deposition of the two types of aerosols are similar, but occur at different rates and degrees of magnitude. The two major mechanisms are coagulation in the mouth and hygroscopic growth in the lung; the latter being particularly influenced by chemical composition, and by high glycerol content in e-cigarette aerosol. In practice, aerosol deposition fraction is high for both; 0.6-0.8 for cigarette smoke and > 0.9 for nicotine, glycerol and propylene glycol, the principal components of e-cigarette aerosol.

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