Nanoparticle deposition in realistic human lung airway models with different inlet conditions

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Abstract

In the present study a mathematical model for nanoparticle deposition in human lung airways is proposed. Transport and deposition of ultrafine particles in straight, curved and bifurcating tubes are measured for different inlet Reynolds numbers, velocity profiles, and particle sizes. The focus is on the airflow structures as well as nanoparticle deposition outlines and deposition efficiencies, which were examined for planar and nonplanar bifurcating lung airway models representing part of the upper bronchial tree. Finite difference method has been used to solve the unsteady nonlinear Navier-Stokes equations in cylindrical coordinate system governing flow assuming axial symmetry under laminar flow condition so that the problem efficiently turn into two-dimensional. An extensive quantitative study is performed through numerical computations of the preferred quantities having physiological importance through their graphical demonstration so as to authenticate the applicability of the current model.

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