

عنوان مقاله:

Numerical Simulation of Mucus Clearance inside Lung Airways

محل انتشار:

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خلاصه مقاله:

Airway mucus is difficult to clear and to improve lung function clearance of mucus is necessary. The deep coughing, chest physiotherapy, high frequency chest wall oscillation etc. are some of the best methods to clear excessive mucus from lung airways. In this article we analysed the behavior of fluid flow between parallel walls, where both walls are porous and the flow is induced by the oscillation of these walls and pressure gradient; which is applicable for clearance of mucus from lung airways. Generalized Couette flow is applicable to model the oscillation of parallel walls, however the laminar flow of viscous fluid is taken under consideration. The generalized Navier-Stokes equations are applied to make various hypotheses and finite difference scheme is used to solve the problem numerically. Effect of wall oscillation, wall porosity, pressure due to porous media on mucus clearance and particle aspect ratio on the deposition of nonspherical nanoparticles are analysed graphically after simulating the problem on MATLAB R۲۰۱۳a by user defined code. Simulation show an excellent agreement of unsteady flow of viscous fluid at large values of time and significant correlation between pressure gradient and porosity of walls, frequency of wall oscillation and their impact on mucus clearance are obtained. In addition it is observed that fluid and particle velocity are increased with the enhancement of media porosity, breathing frequency and aspect ratio. The aim of this paper is to study the influence of wall movement, wall porosity, pressure on wall, wall oscillating frequency on the clearance of mucus from lung airways.

کلمات کلیدی:

Cilia movement, Couette flow, Mathematical modeling, Mucus clearance, Porosity, Particle shape

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