عنوان مقاله:

Numerical modeling and Optimization of Respirational Emergency Drug Delivery Device using Computational Fluid Dynamics and Response Surface Method

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خلاصه مقاله:

Studies have shown that most of the particles sprayed on emergency respirational patients, accumulate inside the endotracheal tube and its connector. In this paper, applying Computational Fluid Dynamics (CFD) and Response Surface Method (RSM), an optimized geometry is introduced for higher efficiency of the drug delivery for patients with emergency respiratory diseases. In CFD modeling, finite volume method and for two-phase flow modeling, Lagrangian method is used. Reynolds averaged Navier–Stokes equations with Reynolds stress turbulence model are solved using SIMPLE pressure correction algorithm within the computational domain. The velocity fluctuations are simulated using the Discrete Random Walk (DRW). For optimization process, six different parameters including three dimensions of the connector of the tube: connector length, connector diameter and injection diameter, injection velocity of the drug particles, air flow velocity and particle size are investigated. Using Design of Experiments (DOE) and RSM, the output efficiency of the model and second-order regression equation model are derived and accuracy of the model is confirmed. Then the effect of each input parameter on the efficiency is investigated. Dringer algorithm is applied to optimize the process and the best combination of input parameters yielding the highest efficiency is introduced.

کلمات کلیدی:

Computational Fluid Dynamics, Drug Delivery Device, Endotracheal tube, optimization, Respirational Patients, response surface method