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Effect of Circulation Chamber Dimensions on Aerosol Delivery Efficiency of a Commercial Dry Powder Inhaler Aerolizer®

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Abstract

Abstract:

Aim of this study was to analyze how modifications in circulation chamber dimensions affect aerosol particle deposition in a Dry Powder Inhaler (DPI) Aerolizer®. Combining computational fluid dynamics (CFD), for simulation of fluid flow (air), with discrete phase model (DPM) for particles simulation, we can better understand particle dispersion within inhalers air flow field. Input in the simulation was 20mg of aerosol particles with initial velocity of 11,79166m/s. Dimension change influences maximum velocities, as well as percentage of deposited particles. Based on these information we were able to calculate the number of particles on the outlet and compare efficiency reduction when circulation chamber height increased. Knowledge obtained in this way can help in device performance optimization.

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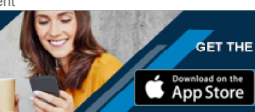
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I. Introduction

Inhaled medication in a form of drug formulation is the most common treatment of pulmonary diseases such as asthma. This field of pharmacy includes good understanding of the physiology of human airways [1]. Some of the widely used inhalers include small-volume nebulizers (SVN), pressurized metered-dose inhalers (pMDI), or the dry-powder inhalers (DPI) [2] which enable aerosol particles (aerosolized drugs) to distribute to the lungs. Dry powder inhalers (DPI) were designed to administer individual doses of drugs in a form of powder contained in capsules that should be pierced before the inhalation process (unidose systems), or in blisters that move around in a device or have powder reservoirs (multidose systems) [3].

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