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The concept design of air nebulizer cup for medical inhalers

Marek Ochowiak[1], Magdalena Matuszak[1], Sylwia Włodarczak[1] and Anna Gościniak[1, 2]
[1]Poznan University of Technology, Poland
[2]Phytopharm Kleka, Poland

The aim of this work was to analyze the effect of aeration on distribution of drop sizes in the aerosol. The aerosol was generated with a pneumatic medical nebulizer fitted with a modified nebulizer cup connected to the additional source of aerating gas. The size of drops formed was analyzed with a digital microphotography with prior capture of drops onto the immersive liquid layer. The photos obtained were analyzed in Image-Pro Plus. The mean drop diameter and volumetric share of drops of 5 μm and 10 μm were analyzed. Based on results, the effect of aeration of liquid on the dispersion process was evaluated. Modification of the nebulizer cup consists in making four holes in the bottom of this vessel. All tubes (used as the aerator) coming out from the holes were connected to the collector to which an additional air stream from another Medel Family pneumatic nebulizer was provided via a hose by rotameter and valve. The valve enables control of the flow rate of additional air fed to the nebulization cup. Dispersion Atomization in pneumatic medical nebulizer with different gas flow rates by dispersed liquid was tested. The tests were conducted within the flow rate of additional gas from 1.39x10-5 to 8.33x10-5 m^3/s. The work also analyzed the size of bubbles flowing out from a single aerator orifice with a flow rate of additional gas from 6.44x10-6 to 8.33x10-5 m^3/s. The analysis of drops size histograms shows that with the higher flow rate of gas, the number of large drops decreases and there are more small drops. With the higher gas flow rate, the drops size distribution curve clearly moves towards the smaller drops. Based on the experimental studies it was found that: An increase in the flow rates of additional gas leads to the increase in the number of small droplets, an increase in the flow rate of aeration gas decreases the number of drops of large diameter, the mean droplet diameter decreases with the increase of the flow rate of additional gas, the results allow to propose a correlation in form of, which describes the mean diameter of droplet (SMD), depending on the volumetric flow rate of additional gas (expressed by Reynolds number Reg), the bubble volume discharging through a single orifice increases with increasing the flow rate of aeration gas and the modifications of construction of atomizer may help to improve the effectiveness of the aerosol therapy by the decrease in the droplets diameter.

Biography

Marek Ochowiak has received his PhD degree in Chemical Technology from Poznan University of Technology. Since 2002 he is working in Institute of Chemical Technology and Engineering, Faculty of Chemical Technology, Poznan University of Technology. Since 2016 he is the head of Department of Chemical Engineering and Equipment. His research interests include chemical and process engineering, mechanics, automatics, especially multiphase systems, atomization process, separation processes and computer analysis of images. He has published more than 28 papers in JCR journals.

marek.ochowiak@put.poznan.pl

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