



Title: The concept design of air nebulizer cup for medical inhalers

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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 $1.39 \cdot 10^{-5}$ to $8.33 \cdot 10^{-5}$ 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 $6.44 \cdot 10^{-6}$ to $8.33 \cdot 10^{-5}$ 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 smaller drops. With the higher gas flow rate, the drops size distribution curve clearly moves towards the smaller drops. Based on these tests it was found that: when the gas flow rate is higher, there are more smaller drops, there are less drops with large diameters; the mean drop diameter decreases under higher flow rate of additional gas stream; the higher gas flow rate increases the volume of the bubble flowing out through a single opening, and it was further found that the design modifications of atomizing equipment could contribute to improving efficiency of aerosol therapy thanks to obtaining smaller diameters of drops.

Biography

Marek Ochowiak received a Ph.D. degree in chemical technology from Poznan University of Technology. Since 2002 works in Institute of Chemical Technology and Engineering, Faculty of Chemical Technology, Poznan University of Technology. Obtained Dr. Eng. Habil. degree in chemical engineering from Silesian University of Technology (2014). Since 2016 he is the head of Department of Chemical Engineering and Equipment. Associate Professor Ochowiak's 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. His hobbies are photography, reading and travel.

Magdalena Matuszak was born in 1988. In 2016, she graduated from Poznan University of Technology, Faculty of Chemical Technology, Institute of Chemical Technology and Engineering and obtained Ph.D. degree. In October 2016 she started to work at Poznan University of

Technology, Department of Chemical Engineering and Equipment as assistant. She research interests include chemical and process engineering, especially: multiphase systems, atomization process, and computer analysis of images. She carry out research, which are concerned with the analysis of the atomization process in medical devices. She has published more than 9 papers in JCR journals. Her hobbies are reading and travel.

Sylwia Włodarczak was born in 1988. In 2016, she graduated from Poznan University of Technology, Faculty of Chemical Technology, Institute of Chemical Technology and Engineering and obtained Ph.D. degree. In October 2016 she started to work at Poznan University of Technology, Department of Chemical Engineering and Equipment as assistant. She research interests include chemical and process engineering, especially: design of chemical apparatus, atomization process, and computer analysis of images She carry out research, which are concerned with the analysis of the atomization process in atomizers of different construction. She has published more than 6 papers in JCR journals. Her hobbies are reading, music and film.

Anna Gościniak was born in 1992. In 2016, she graduated from Poznan University of Technology, Faculty of Chemical Technology and obtained master degree. In January 2016 she started to work in pharmaceutical industry as HPLC analyst. The company uses cutting-edge technologies and equipment to produce extracts from fresh and dried plants. She research interests include chemical and process engineering, especially: controlling systems in chemical industry, atomization process, and nebulizer equipment. In studies she presents the nebulizer spray chamber temperature controller responsible for controlling temperature of aerosol produced as a result of nebulizing process. She has published 1 papers in JCR journals. Her hobbies are reading, music and sewing machine.

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