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Particle-size distribution of dust created during sanding the modified ash wood

TOMASZ ROGOZIŃSKI[1)], LUĎKA HLÁSKOVÁ[2)], MAREK WIERUSZEWSKI[3)], ALENA OČKAJOVÁ[4)]
[1)]Department of Furniture Design, Faculty of Wood Technology, Poznan University of Life Sciences
[2)]Department of Wood Processing, Faculty of Forestry and Wood Technology, Mendel University of Agriculture and Forestry in Brno
[3)]Department of Wood Based Materials, Faculty of Wood Technology, Poznan University of Life Sciences
[4)]Department of Technology, Faculty of Natural Sciences, Matej Bel University Banska Bystrica

Abstract: *Particle-size distribution of dust created during sanding the modified ash wood.* The paper presents the results of the particle size distribution of dust from sanding thermally modified wood ash at three temperature levels and comparatively unmodified wood. It has been found and described the effect of temperature in the process of modification of wood on the content of particles belonging to the smallest fraction of dust dreated during sanding.

Keywords: wood dust, sanding, ash wood, thermal modification

INTRODUCTION

Secondary woodworking is a source of some amount of dust. This dust, when dispersed in the air surrounding the working positions, can be inhaled by employers. So they can be exposed to many occupational diseases related to wood dust (***Kauppinen et al., 2006, Jacobsen et al., 2010***, ***Kos et al., 2004, Čavlović et al., 2013***). Implementation of new materials and technologies in woodworking industry is the cause of new risks associated with wood dust. Therefore, each of these materials should be evaluated in terms of their impact on air quality in the workplace. The amount of generated dust, its characteristics with particular attention to the particle size, the possibility of its efficient removal from the machining area and their separation in dust collectors are important in the evaluation. Sanding of wood especially using hand sanding machines belongs to the highest dust problems of the working environment (***Scheeper et al., 1995, Palmqvist and Gustafsson, 1999, Detering et al., 2000, Očkajová, et al., 2008, Očkajová, et al., 2010***). Products of thermal wood modification when machined pose additional risks associated with the higher degree of fineness of created dust. It was reported by ***Dzurenda et a***l. (***2010***), ***Dzurenda and Orłowski*** (***2011***), ***Dolny et al. (2011***). But there are not available results relating to the finest fractions which are difficult to isolate by conventional means, for example by sieve analysis. The aim of this paper is to determine the effect of the thermal modification of ash wood (*Fraxinus excelsior* L.) on the content of the smallest particles in dust created during sanding process on belt sanding machine using laser light scattering method.

MATERIALS AND METHODS

The samples of thermally modified ash wood samples with dimensions 300 × 80 × 15 mm were taken from the industrial workshop to the experiment. The samples were worked on the belt sander type DSCLD 200 (Gomad, Poland) in the longitudinal direction. The sanding paper with granulation signed 120 was used the experiment. Pressing force of the sanding belt to a sample was fixed on the level of 30N and measured by a force sensor. Dust created during sanding was exhausted by the portable dust extractor type OWP-1 (Aerotech, Poland) Dust collected by the extractor was used for the particle-size determination. It was done using a Laser Particle Sizer Analysette 22 MicroTec plus (Fritsch, Germany), which operates basing on the laser diffraction method in a measuring range of 0.8 to 2000 µm. Graphs presenting the cumulative and discrete particle size-distribution of tested dust are generated by the software MaScontrol during the measurement. This method of wood dust particle-size measurement was described in detail by ***Rogoziński et al.*** **(*2015*)**. The function of distribution can be a base for calculation of particle percentage in any dimensional range. In this experiment there were fixed 3 ranges of the finest dust < 2.5 µm, 2.5 – 4 µm, and 4 – 10 µm.

RESULTS

Figures 1,2,3 and 4 show the results of the analysis of dust taken from the dust collector connected to the sanding machine. The plots presented on these figures were generated by MaScontrol software at analyzing of measuring data of the laser particle sizer. On the plots, it can be seen two types of quantities:

- the cumulative distribution Q_3,
- the discrete density distribution q_3,

which are the empirical functions of particle-size distribution.

It should be noted that the dust created during sanding the unmodified and thermally modified ash wood is very fine. Occurrence of the particles with the size smaller than 100 µm which is expressed by distribution Q_3 is always more than 90%.

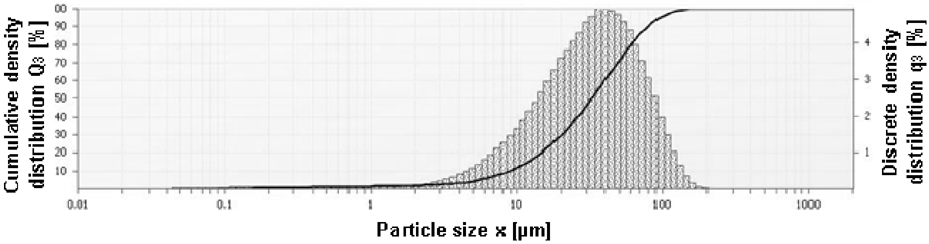

Fig. 1 Particle size distribution of dust from sanding native ash wood

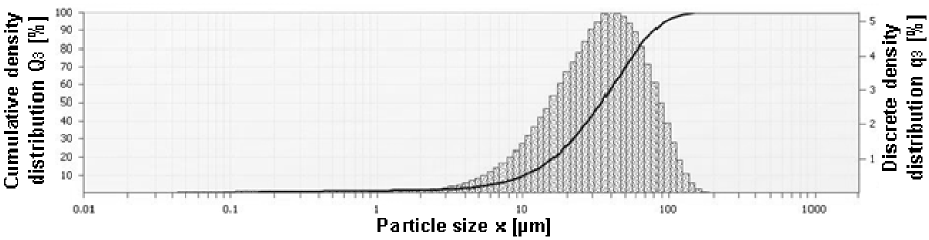

Fig. 2 Particle size distribution of dust from sanding ash wood modified in temperature 190°C

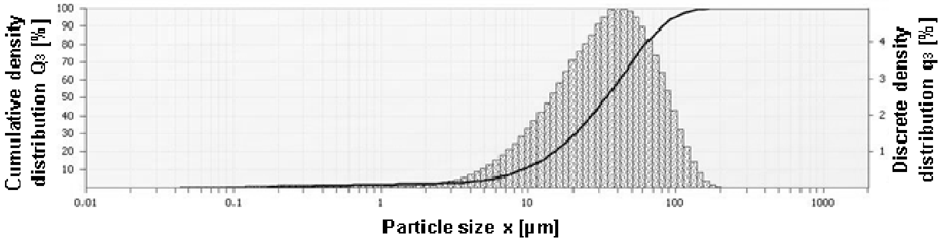

Fig. 3 Particle size distribution of dust from sanding ash wood modified in temperature 200°C

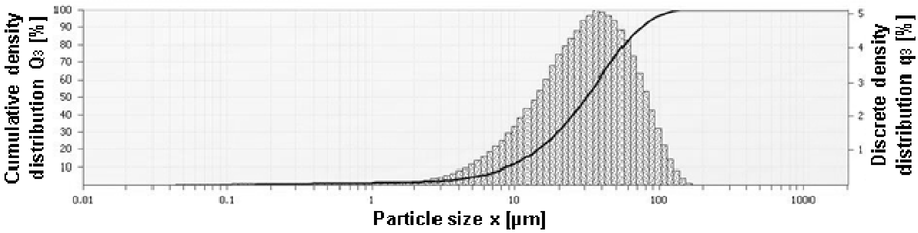

Fig. 4 Particle size distribution of dust from sanding ash wood modified in temperature 220°C

On the basis of the particle-size distributions generated during the measurements by the laser particle sizer, the assumed fractions of dust were calculated. Content of dust in the fractions is presented on figure 5. There is no change in this content between dust from unmodified wood and wood modified at 190°C. Sanding of wood modified at higher temperatures gives the dust with significantly higher content of very fine particles. It is up to more than 16% of the total created dust having a particle size of less than 10 µm.

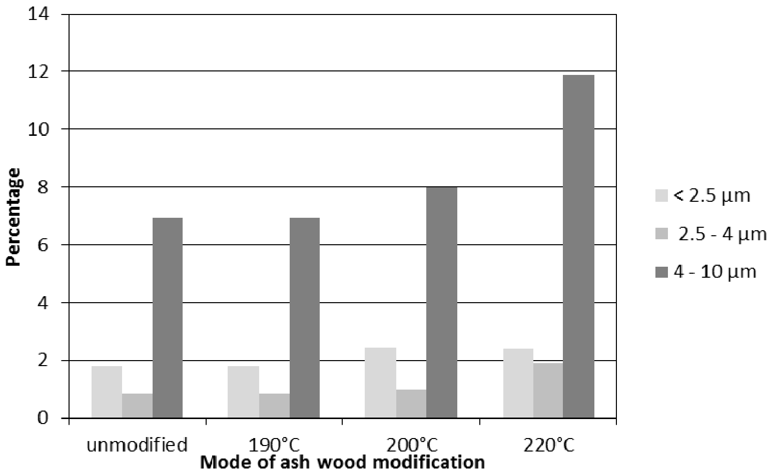

Fig. 5 Content of the finest particles in dust created during sanding of modified ash wood

CONCLUSION

1. Mode of thermal modification of ash wood influences on the content of the very fine particles in dust created during sanding operation.
2. The content of dust particles in the assumed fractions is very similar for unmodified wood and wood modified at the temperature level of 190°C.

3. Dust from sanding of wood modified at a temperature of 220°C is a source of about 70% more of total dust in the assumed fractions than dust from sanding of wood modified at a temperature of 190°C and 40% more than at a temperature of 200°C

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Streszczenie: *Rozkład wielkości cząstek pyłu powstałego podczas szlifowania modyfikowanego drewna jesionu*. W pracy przedstawiono wyniki badań rozkładu wielkości cząstek pyłu powstałego podczas szlifowania drewna jesionu modyfikowanego termicznie przy trzech poziomach temperatur i porównawczo drewna niemodyfikowanego. Stwierdzono i opisano wpływ temperatury w procesie modyfikacji drewna na zawartość cząstek zaliczanych do najdrobniejszych frakcji pyłowych powstałych podczas szlifowania.

Corresponding author:

Tomasz Rogoziński,
Department of Furniture Design, Faculty of Wood Technology,
Poznan University of Life Sciences,
Wojska Polskiego str.28
60-627, Poznan,
Poland
email: trogoz@up.poznan.pl
phone: +48618487483