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# Dust load of pulse-jet filters in furniture industry

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**Abstract:** *Dust load of pulse-jet filters in furniture industry*. The paper presents the comparison of dust load of two pulse-jet filter installed in different furniture factories. A characterization of dusts separated in the filters were done. Basic properties of the dusts were determined. Significant differences in the particle size distribution, bulk density and angle of repose of the dusts were found.

*Keywords*: wood dust, pulse-jet filter, furniture production

## INTRODUCTION

Thanks to their versatility, pulse-jet fabric filters are commonly used to air cleaning from dust pollution in industrial plants. This also applies to dust, sawdust and other wood particulate waste created in furniture manufacturing (***Dolny 2007, Mukhopadhyay 2010***). In these plants, the production is carried out on different scales using different wood materials and machining equipment. That is the cause of a considerable variability of the characteristics of dust removed in exhaust installations equipped with filtering separation devices (***Chung et al. 2000, Očkajová et al. 2008, Očkajová et al. 2010, Očkajová et al. 2014***). Also the amount of dust waste can be different in different factories. It may be the cause of the uncertainty regarding the proper selection of size and type and operating parameters of separators. Therefore, there is a need for research to determine the technical and technological design guidelines in this regard. In the initial phase it should include an assessment of the performance of existing dedusting installations. The comparison described in this work is a part of the initial phase of the research tasks contained in the program of research on the use of filter dust collectors in the woodworking industry.

## MATERIALS

Two installations equipped with pulse-jet fabric filters were subjected to a comparative evaluation in terms of their load and working conditions. They operate in two furniture production plants described in the further part of text as factory A and factory B. These installations differ in their size, type and number of connected machines, and most importantly in the properties of dust flowing into the filtration devices. Basic differences of the filters were shown on fig. 1 Details on connected woodworking machines were shown in table 1. The basic properties of the dust separated in the filters were determined experimentally. In this field the dust sieve analysis was carried out in accordance with the standard PN-ISO 2591-1:2000. Angle of repose (PN-Z-04002-08:1974), sliding angle of repose (PN-Z-04002-07:1974) and bulk and tapped bulk densities (PN-Z-04002-02:1974) were determined too.

## RESULTS

The results of sieve analysis of dust separated in filters installed in the plants covered by the research were shown on figures 2 and 3. The dust coming from the factory A is finer. This difference may result from the reason that during processing MDF in factory plant particles B obtained in the nature of the fibrous In this case two dimensions of a particle are small and the third dimension significantly exceeds them. This fact has a considerable influence on the result of particle size analysis.

Tab. 1 Working equipment and material

| | **Factory A** | **Factory B** |
|---|---|---|
| **Machines** | Saw machine<br>4 × duble end-tenoner<br>2 × single sided sizing and edge machine | CNC router<br>Format saw<br>Four-side planer<br>Spindle moulder |
| **Materials** | Honeycomb board (particleboards and MDF) | MDF |


Fig. 1 Filters

This supposition can be confirmed by higher values of bulk densities (Fig. 4) of dust coming from the Factory B. It seems that the particles of this dust are finer than would appear from the sieve analysis. This type of problems with evaluation of the particle size of wood dust was already found in similar works (Rogoziński and Očkajová 2013, Rogoziński et al. 2015).

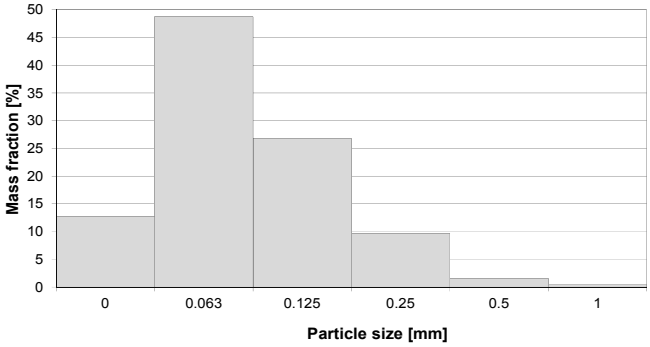


Fig. 2 Particle-size distribution of dust coming from Factory A

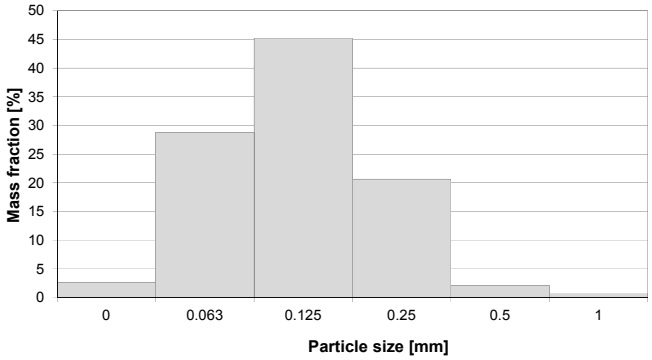


Fig. 3 Particle-size distribution of dust coming from Factory B

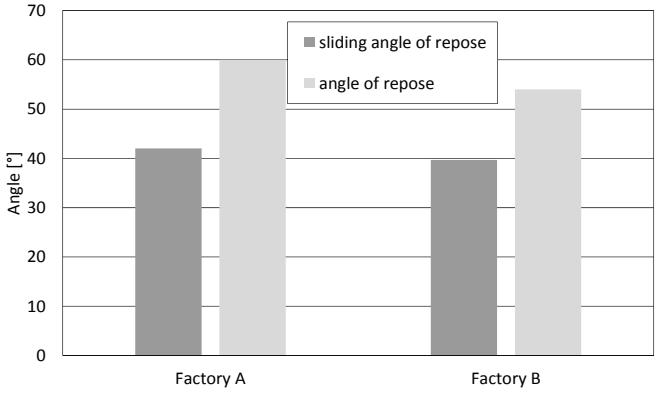


Fig. 4 Angle of repose

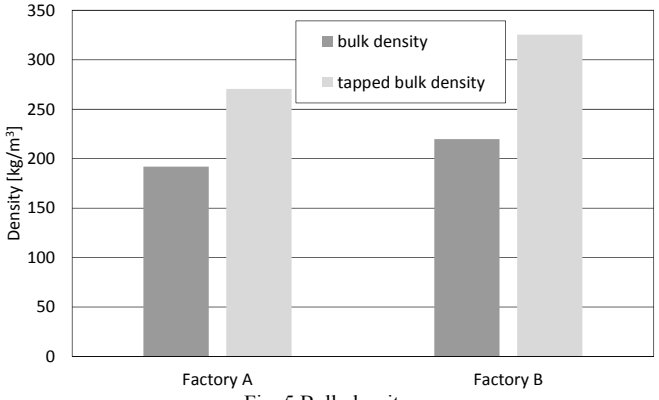


Fig. 5 Bulk density

Analysis of the data shown in Fig. 3 depicting the results of the angle of repose and the sliding angle of repose tends to a similar conclusion. These angles have higher values for dust from the Factory A. Simultaneously the bulk density of dust from the factory B is higher than the bulk density of dust from the Factory A and it would suggest the greater fragmentation degree of the dust coming A.

CONCLUSION

On the basis of the comparison described in this work it can be concluded that the pulse-jet filter dust collectors in the furniture industry can operate under different dust load conditions. But the wood dust is not a substance with constant characteristics and their variability may affect the operation of a dust collector. It is therefore appropriate to pay particular attention to the properties of dust in the design and selection of equipment and processes of filtering dust separation.

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LIST OF STANDARDS

1. PN-ISO 2591-1:2000 Analiza sitowa -- Metody z zastosowaniem sit kontrolnych z tkaniny z drutu i z blachy perforowanej.
2. PN-Z-04002-08:1974 Ochrona czystości powietrza -- Badania fizycznych własności pyłów -- Oznaczanie kąta zsypu pyłu.
3. PN-Z-04002-07:1974 Ochrona czystości powietrza -- Badania fizycznych własności pyłów -- Oznaczanie kąta nasypu pyłu.
4. PN-Z-04002-02:1974 Ochrona czystości powietrza -- Badania fizycznych własności pyłów -- Oznaczanie gęstości pozornych oraz statycznych porowatości warstwy pyłu.

**Streszczenie**: *Obciążenie pyłowe odpylaczy filtracyjnych w przemyśle meblarskim*. W pracy przedstawiono porównanie w zakresie obciążenia pyłowego dwóch odpylaczy filtracyjnych pracujących w różnych fabrykach mebli. Dokonano charakterystyki pyłów wydzielanych w tych filtrach. Określone zostały podstawowe właściwości pyłów. Stwierdzono znaczące różnice w zakresie składu ziarnowego, gęstości pozornych oraz kąta zsypu i nasypu pyłów.

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