

## INDUSTRIAL WOOD CHIPS FRACTIONS

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**Abstract.** The wood chips (product of chipping) can be assigned for production of particle and fibre boards. The object of the performed investigations was to determine fractions of industrial wood chips. The chips were harvested with chippers of various kinds. The determination of chips fractions was based on 5 fraction classes. In all the samples, fraction 10-35 mm was the most numerously represented. For all the experimental surfaces no statistical substantial differences between < 2 mm fraction and > 50 mm fraction were found. The results of fractions of industrial wood chips dimensions were up to Polish standards of industrial wood chips dimensions.

**Key words:** wood chips fraction, wood chips dimensions, industrial wood chips

### INTRODUCTION

Chips (or small parts of wood) emerge in result of wood crumbling with chippers (chipping). Dimensions of chips are included within borders from several millimeters to several centimeters. Depending on the sort of timber, dimension and ownership, wood chips can be assigned for production of particle and fibre boards, cellulose, for extraction of resin and tannins, for production of ferroalloys [Rzadkowski 1995]. In many countries, in Poland too, wood chips are utilized as fuel.

The Polish Standard [PN-91/D-95009 – Zrębki leśne] determines the terms of chips harvesting in Polish forests. According to this standard, the industrial wood chips for production of particle and fibre boards can be harvested from coniferous timber of all kinds and from leafy timber of: birch, beech, hornbeam, lime, alder, aspen, poplar and willow. The coniferous wood chips for production of fibre board can include the leafy wood chips for 20% and the wood chips for production of particle boards for 3% or more, is admissible, depending on agreement with recipient. The wood chips for production of ferroalloys can be harvested from leafy timber of all kinds.

According to Polish Standard [PN-91/D-95009 – Zrębki leśne] dimensions of wood chips are the following:

- a) the coniferous wood chips
  - for production of fibre boards – the fundamental fraction (not less than 81%) from 6 to 32 mm, the fraction over 32 mm not more than 15%

- for production of particle boards – to 60 mm, the fundamental fraction (not less than 51%) from 6 to 32 mm, the fraction over 32 mm not less than 45%
- b) the leafy wood chips
- for production of fibre boards – the fundamental fraction (not less than 80%) from 6 to 32 mm, fraction over 32 mm not more than 15%
  - for production of particle boards – to 60 mm, the fundamental fraction (not less than 51%) from 6 to 32 mm, the fraction over 32 mm not less than 45%
  - for production of ferroalloys – the fundamental fraction (not less than 75%) from 6 to 32 mm, the fraction over 32 mm not more than 15%.

The object of performed investigations was to determine fractions of industrial wood chips. The chips were harvested with chippers of various kinds. The determination of chips fractions was based on 5 fraction classes.

## MATERIAL AND METHODS

The research was carried out in experimental pine stands (I, II and III age classes), situated in forest divisions of: Krzystkowice (1), Ośno Lubuskie (2-3) and Rzepin (4).

Rolls and rods were harvested and chipped in all the experimental areas, within the confines of improvement cuttings. On surface 1 the chipping was carried out with a chipper DVWD-117 jointed with Ursus 912 tractor. On surfaces 2 and 3 the wood was chipped with a chipper Bruks 1002CT and on surface 4 with a chipper Bruks 800CT.

In total, approx. 190 m<sup>3</sup> industrial wood chips were harvested from the investigation surfaces (1-4). Three independent samples from each surface in the amount 5 kg each were collected for determination of fractional composition of wood chips. The collected material seeded by array of sieves about diameter of mesh: 2 mm, 10 mm, 35 mm, 50 mm. The obtained fractions were weighed with accuracy to 1 gram. The percentage participation of fractions with dimensions: < 2 mm, 2-10 mm, 10-35 mm, 35-50 mm and > 50 mm was defined.

The estimation of differences between average values participation of industrial wood chips fractions on experimental sites was performed on the basis of statistical analysis (Tukey T-test).

## RESULTS OF INVESTIGATIONS

The results of the investigations are shown in Table 1. In all the samples, fraction 10-35 mm was the most numerous, then fraction 35-50 mm was second most numerously represented. The thickest fraction (> 50 mm) and slightest fraction (< 2 mm) were represented faintly. The industrial wood chips dimensions were up to Polish standards of industrial wood chips dimension.

The mean squares from analysis of variance for industrial wood chips fractions on experimental sites 1-4 are shown in Table 2. The mean values of industrial wood chips fraction on experimental sites 1-4 are shown in Table 3. For all the experimental surfaces no statistical substantial differences between < 2 mm fraction and > 50 mm fraction were found. Besides, for surface 1 no statistical substantial differences between < 2 mm fraction, 2-10 mm and > 50 mm fraction were found, too.

Table 1. The participation of industrial wood chips fractions in analysed samples, which were harvested on experimental sites (1-4)

Tabela 1. Udział frakcji wymiarowych pozyskanych zrębków przemysłowych w analizowanych próbkach na poszczególnych powierzchniach badawczych

Dimensions of fractions Wymiary frakcji mm	Area – Powierzchnia											
	1			2			3			4		
	the participation of industrial wood chips fractions in each sample, % udział frakcji w poszczególnych próbkach, %											
	1	2	3	1	2	3	1	2	3	1	2	3
<2	1	1	1	1	2	3	2	3	1	0	0	0
2-10	5	3	4	9	8	7	20	19	21	6	8	7
10-35	81	81	84	83	85	81	70	74	72	90	89	88
35-50	12	14	10	6	4	8	6	4	5	3	2	4
> 50	1	1	1	1	1	1	1	1	1	1	1	1
Total Razem	100	100	100	100	100	100	100	100	100	100	100	100

Table 2. Mean squares from analysis of variance for industrial wood chips fractions on experimental sites 1-4

Tabela 2. Średnie kwadraty z analizy wariancji frakcji zrębków przemysłowych na powierzchniach badawczych 1-4

Source of variation Źródło zmienności	Degrees of freedom Liczba stopni swobody	Area – Powierzchnia			
		1	2	3	4
		mean squares – średnie kwadraty			
Industrial wood chips fractions Frakcje zrębków przemysłowych	4	3 664.5*	3 745.5*	2 710.5*	4 485.0*
Residual – Błąd	10	1.6	2.0	1.4	0.6

\*Significant at 0.001 level.

\*Istotne na poziomie 0,001.

Table 3. Mean values of industrial wood chips fractions for experimental sites 1-4 and lowest significant difference – LSD<sub>0,001</sub>Tabela 3. Wartości średnie procentowych udziałów poszczególnych frakcji zrębków przemysłowych na badanych powierzchniach 1-4 i najmniejsza istotna różnica – NIR<sub>0,001</sub>

Area Powierzchnia	Mean value of industrial wood chips fractions, mm Wartości średnie frakcji zrębków przemysłowych, mm					Lowest significant difference – LSD <sub>0,001</sub> Najmniejsza istotna różnica – NIR <sub>0,001</sub>
	< 2	2-10	10-35	35-50	> 50	
1	1.00	4.00	82.00	12.00	1.00	4.737
2	2.00	8.00	83.00	6.00	1.00	5.296
3	2.00	20.00	72.00	5.00	1.00	4.431
4	0.00	7.00	89.00	3.00	1.00	2.901

The substantial differences were found with Tukey T-test application: for  $< 2$  mm fraction (between surfaces: 2 and 4, 3 and 4), for 2-10 mm fraction (between surfaces: 1 and 3, 2 and 3, 3 and 4), for 35-50 mm fraction (between surface: 1 and 3, 1 and 4). In case 2-10 mm fractions the most mean values of industrial wood chips fraction (20) was for surface 3. In case 10-35 mm fraction the lowest mean values of industrial wood chips fraction (72) was for surface 3, too. In case of  $> 50$  mm fraction no statistical differences were found.

## CONCLUSIONS

1. In all the samples, fraction 10-35 mm was the most numerous.
2. For all the experimental surfaces no statistical substantial differences between  $< 2$  mm fraction and  $> 50$  mm fraction were found.
3. The industrial wood chips dimensions were up to Polish standards of industrial wood chips dimension.

## REFERENCES

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## ANALIZA FRAKCYJNOŚCI ZRĘBKÓW PRZEMYSŁOWYCH

**Streszczenie.** Pozyskiwane podczas zrębkowania w lesie zrębki między innymi mogą być surowcem do produkcji płyt wiórowych i pilśniowych. Celem przeprowadzonych badań było określenie frakcyjności zrębków przemysłowych, uzyskanych z użyciem różnych typów maszyn zrębkujących, na podstawie pięciu klas frakcyjności. We wszystkich próbkach poddanych analizie najliczniej reprezentowana była frakcja o wymiarach 10-35 mm. We wszystkich badanych powierzchniach nie zaobserwowano różnic statystycznie istotnych pomiędzy frakcjami  $< 2$  mm i  $> 50$  mm. Wyniki uzyskane w badaniach odpowiadały obowiązującej w naszym kraju normie, określającej wymiar pozyskiwanych zrębków przemysłowych.

**Słowa kluczowe:** frakcyjność zrębków, wymiary zrębków, zrębki przemysłowe

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