

The Influence of Chip Quality on the Physicomechanical Properties of Particleboards

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Introduction

Due to the rising prices of timber and growing demand for wood-based materials the manufacturers of wood materials are forced to search for methods which will increase the efficiency of the available supply of raw materials. Shredded raw materials which are waste products of a different manufacturing technology can be used for the production of particleboards. The particleboard industry can use wood materials obtained by shredding smaller pieces of wood, which are waste products resulting from the manufacturing of other wood materials (waste from the sawmill industry) or the shredding of used wood. Unshredded material delivered to a sawmill is usually pre-shredded into woodchips and then it is cut into proper chips. Particleboard plants also acquire sawdust and chips during the processing of solid wood. 10-40% of this form of wood material is usually mixed with proper chips.

The aim of this study was to investigate the possibility to use unconventionally-shaped chips obtained by solid wood processing for the production of particleboards. Chips acquired from pinewood planks planed with a jointer-planer and from pieces of pinewood cut with a laboratory woodchip cutter were used in the study. Both types of chips were of similar bulk density, i.e. about 160 kg/m³. The chips were used for the production of boards with densities of 450 kg/m³ and 525 kg/m³. The chips were glued with pMDI, where 5% of the dry weight of the adhesive was used for the dry weight of wood. Three-layer boards were manufactured, because they differed in the moisture of chips in individual layers. The share of the layers was 50% : 50%.

The physicomechanical properties of the boards were evaluated according to the relevant standards. The study showed that the boards made from conventionally obtained chips were characterised by much better properties than the boards made from the chips acquired by wood planing.



Sawdust particleboard



Chip particleboard

Results

	Testing method	Sawdust particleboard		Chip particleboard	
		450 kg/m ³	525 kg/m ³	450 kg/m ³	525 kg/m ³
Particle analysis					
Dimensions of chip [mm x mm x mm] length x width x thickness)		9,79 x 1,68 x 0,19		9,52 x 1,63 x 0,93	
Density [kg/m ³]	PN-EN 323: 1999	450 kg/m ³	525 kg/m ³	450 kg/m ³	525 kg/m ³
Moisture [%] outer layer/ inner layer	PN-EN 322: 1999	24/7	24/7	24/7	24/7
Bending strength major axis [MPa]	PN-EN 310	4,9	9,2	17,69	19,55
Modulus of elasticity: major axis [Mpa]	PN-EN 310	919,2	1689,5	2805	3030
Tensile strength perpendicular to the board plane [MPa]	PN-EN 319	0,281	0,469	0,49	0,586
Thickness swelling after 2 hrs [%]	PN-EN 317	12,1	11,3	11,4	10,9
Thickness swelling after 24 hrs [%]	PN-EN 317	18,1	18,6	12,6	12,7
Moisture resistance. Boil test [Mpa]	PN-EN 1087-1 : 1999	0,107	0,157	0,185	0,21

Conclusions

- The geometrical shape of the chip formed during the machining process of the same material on various machine tools has a significant effect on the mechanical properties of the particleboard.
- Chips, which were used for chipboards production were characterized by similar length and width but the difference was in thickness of chips.
- Considerably lower values of boards strength were obtained during machining on thickness planer and they were caused by worse glue distribution and thus worse bonds between particular chips
- The mechanical properties of the former boards met the requirements of standard EN 312 for P5 boards. The properties of the latter boards did not even meet the requirements of lower types of boards described in the standard.



Chips



Sawdusts

Use standards

- PN-EN 310 : 1994** Wood-based panels: Determination of modulus of elasticity in bending and of bending strength
- PN-EN 312 : 2005** Particleboards. Specifications
- PN-EN 317 : 1999** Particleboards and fibreboards – Determination of swelling in thickness after immersion in water
- PN-EN 319 : 1999** Particleboards and fibreboards – Determination of tensile strength perpendicular to the plane of the board
- PN-EN 322 : 1999** Wood-based panels – Determination of moisture content
- PN-EN 323 : 1999** Wood-based panels – Determination of density
- PN-EN 1087-1 : 1999** - Particleboards. Determination of moisture resistance. Part 1: Boil test



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