Influence of antipiren on the properties of small density wood plates

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Abstract. In this work a new method of small density wood plates obtaining without adhesives use based on preliminary hydrodynamic processing of wood is offered. It has been established that this method allows to receive the plates with indexes of physicomechanical properties and water resistance surpassing the known analogs made with the use of synthetic adhesives.

1. Introduction
Wood plates are widely applied as constructional and heat-insulating materials. At the same time in most cases synthetic adhesives which in turn predetermine toxicity of plate materials are used for production. Due to severe restrictions on this index, especially in living premises, a large number of studies directed to this question solution are carried out. They are generally aimed at finding new adhesives or modification of the known. In the works [4, 6] it is established that obtaining materials without binding agents with high operational properties use is possible. In most cases it requires wood pre-treatment. Thus in the work [5] it is claimed that at particle sizes of lignosellulosic raw materials decrease physicomechanical properties of plates without glue use increase. In a number of works it is noted [4, 6] that physicomechanical properties of plate materials significantly depend on fractional composition of initial wood pulp. Our previous studies [2] point to the effectiveness of preliminary hydrodynamic activation of wood particles for obtaining plates of average density without adhesives use. Such processing allows to obtain wood particles with a big specific surface area which depends on the form and the size of wood particles. At increase in an external surface of wood pulp particles more dense and uniform stacking is reached, the particles contact surface increases that causes the increase in the intermolecular interactions number.

The plates of average density (from 650 to 850 kg/m$^3$) are used in construction and wood processing in a large number. At the same time obtaining of small density plates (from 200 to 350 kg/m$^3$) is of great interest. Such plates have a low heat and sound conductivity that is very important, for example, at manufacturing of enclosure structures in construction. Such plates obtaining is a serious problem. Due to low density contact area between wood particles in a plate decreases dramatically what complicates its structure development. Thus, to obtain low density plates without binding agents from wood particles with high physicomechanical properties it is necessary for mechanical wood pulp to have a high specific surface area since binding formation (autohesion interaction) between wood particles during plates obtaining depends on it.

The most available raw material for plates manufacturing is the crushed woodworking waste – sawdust. The possibility of obtaining competitive production from this wastage is extremely limited.
Proceeding from this, we conducted the research directed to the studying of obtaining low density wood plates possibility from the sawdust tentatively subjected to hydrodynamic activation.

2. Materials and research techniques.

In the research works Siberian larch (Lárix sibírica) sawdust received on the timber sawing machine was used. Activation of sawdust was made by means of a laboratory hydrodynamic disperser of a rotary–pulsating type. The processing was carried out at the hydromodule 1:10. As a criterion for estimation of mechanical wood pulp processing degree we accepted an index of water-retaining ability – WRV which was determined according to Dzhayma technique [3]. The mechanical wood pulp obtained as a result of hydrodynamic processing was filled in a form. Mechanical squeezing in a cold press was made for mechanical wood pulp dehydration and consolidation. The density of ready plates depends on the value of the pressure. During the research squeezing was carried out with the pressure of 0,5 MPa. The given thickness of plates was 50 mm. After, the plates were placed in a convective drying chamber. The drying was carried out at 105 °C and a circulation time of the drying agent of 2,5 m/s to plates humidity of 4%. At this humidity the plates density was ≈ 250 kg/m³. Drying duration was 24 hours. After drying the plates were kept in the laboratory conditions, and then the samples for determination of tensile strength at bending, stretching perpendicularly of the face and swelling sizes after soaking in water within 24 hours were made from them.

3. Results and Discussion

As the results of research works showed (figure 1) low density plates properties significantly depend on an initial mechanical wood pulp WRV index. Tensile strength at bending (figure 1a) and at stretching perpendicularly the face (figure 1b) with increase in an WRV index from 100% to 250% respectively increase in 12,5 and 5 times. Sharp increase in plates strength indexes is observed after increase in WRV more than 200%. The obtained results indicate that considering strength characteristics the studied material surpasses the low density plates with synthetic adhesives use, for example Glunz, produced according to the standard [1].

![Graph](image-url)
The size of plates swelling at soaking in water within 24 hours does not significantly depend on mechanical wood pulp processing degree. At the same time this index values are much lower than it is allowed by the standard for similar wood plates [1]. The peculiarity of the obtained plates is that after the wetted plates drying their sizes return to their initial values. And this is observed at multiple repetition of soaking and drying. It is necessary to highlight that after drying the plates indicators of durability are from 80% to 100% of initial values. The obtained results can be explained as follows: at the increase in a mechanical wood pulp processing degree the quantity of particles with a big specific surface area increases. As we noted earlier, it allows to receive the greater number of contacts between particles that causes the increase in values of plates physico-mechanical properties. All similar wood plates which are made with synthetic adhesives use completely lose mechanical characteristics even at single humidification and drying. High water resistance of the received plates allows to broaden the sphere of their application considerably. They can be used in premises with high air humidity, in the conditions of contact with an atmospheric precipitation, as fixed timbering and etc.

4. Conclusion
1. Preliminary hydrodynamic processing of sawdust allows to obtain plates of low density without adhesives use.
2. Mechanical characteristics of plates depend on the degree of hydrodynamic wood processing. With increase in WRV index the plates strength at bending and at stretching perpendicularly to face increases. The most significant increase in strength occurs after WRV rise more than 200%.
3. Indexes of low density plates strength obtained without adhesives use do not concede to similar plates produced with adhesives use. The obtained plates have high water resistance that broadens the sphere of their application.

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