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DEVELOPMENT OF COMPOSITION OF PELLET ON THE BASIS WOOD BIOMASS FROM LOGGING WASTE

The real researches are directed on study of influence of waste of logging in compositions pellet on their main figures of merit. Woody biomass feedstock was to obtain experimental samples of pellets - sawdust, pine needles and bark. Complex and contradictory nature of the influence of each component of woody biomass was studied on a set of properties of pellets. Found that the optimum content of the investigated components in the composition is sawdust – 70%, needles – 5% and bark – 25%. In this case the best combination of values of quality pellets obtained: density – 1.49 g / cm³, ash content - 0.42%, and the mechanical strength – 6.5 MPa. Release on the results of studies conducted an experimental batch of pellets.

Introduction. Rational use of waste wood is one of the main tasks of the problem of improving the use of wood raw material. In this connection, improving the structure of its consumption is of great interest. Wood waste generated in the process, even in small amounts, the use of which does not provide production technology. It leads to the formation of large dumps of waste on the territory of the enterprises, or is blocked with time.

Wood waste is exposed to air, moisture, bacteria, fungi and insects, while in large piles. In this case, biomass waste is destroyed with the release of a greater number of different substances decay of wood and bark, many of which are toxic and carcinogenic [1].

Wood waste on physical and mechanical properties, shape and size can be classified as shown in Fig. 1 [2].

Involvement of all types of waste wood, sawmill and logging in the process of obtaining wood pellets can be one of the promising areas full use of tree biomass.

Main part. The relevance of these studies is due to the fact that the timber industry is inevitably produced wood waste in the form of individual parts of a tree (pine needles, leaves, branches, bark). They make up 20% of the total weight of the timber and are still untapped. Properties of the main waste woody biomass in the table. They are of interest in terms of their use as a raw material for the production of pellets.

Analysis of the raw material base of production of wood pellets shows that, firstly, the technology, structure and cost of the equipment, energy and labor-intensive industries dependent on the quality of raw materials, and consequently - the value of investments and the level of the cost of the finished product.

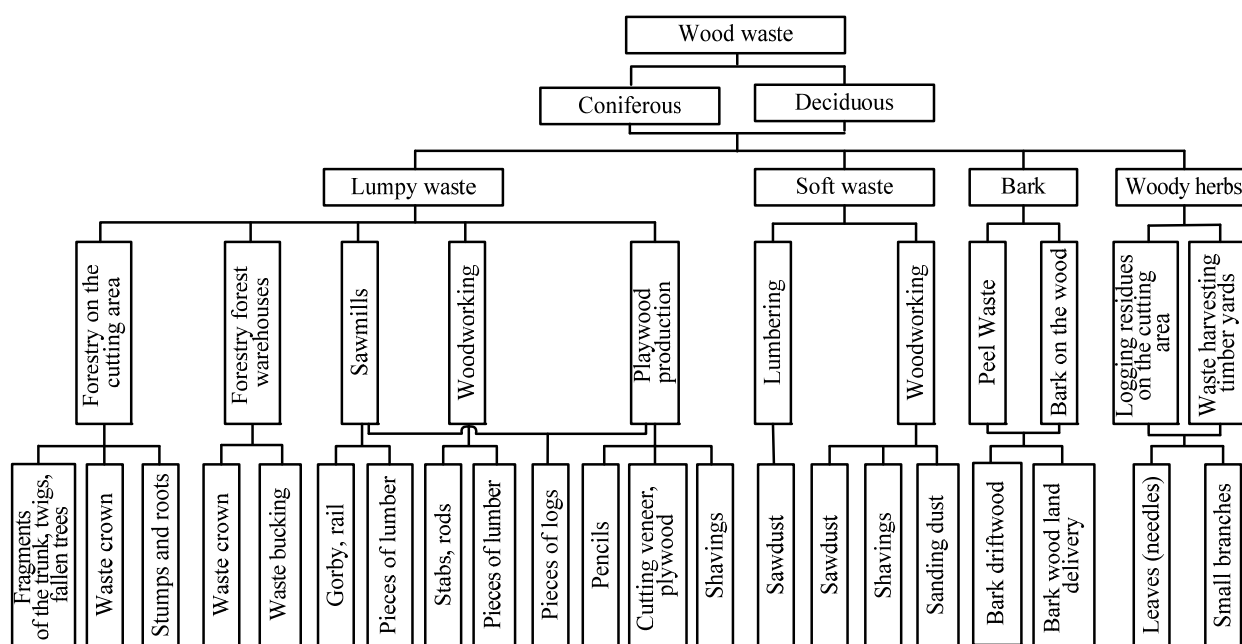


Fig. 1. Classification of wood waste

Secondly, the quality of the pellets from it depends on the composition and physical properties of the material. Logging waste in the form of bark and needles differ in their structure, physical, mechanical and chemical properties of the stem wood of smaller fiber, which makes them less mechanical strength [3].

Physical properties various waste wood biomass

Type woody biomass	Humidity, %	Ash content, %	Heat combustion, MJ/kg	The sulfur content, %
Sawdust	8–60	0.4–0.6	16–18	0–0,3
Needles	35–55	1–5	19–21	0.02–0.05
Bark	21–65	2–6	20–25	0–0.1

The influence of quantitative relations sawdust, bark and needles of the properties of the finished products, in order to establish the source of the raw material is a waste woody biomass in general, to obtain pellets, which could provide the best of their physical and mechanical properties. Applied simplex-lattice planning of the fourth order to solve the problem [4]. Location of the experimental points in the factor space simplex lattice Plan (Plan Scheffe) is shown in Fig. 2.

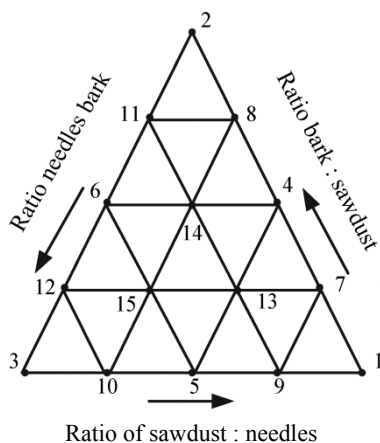


Fig. 2. Location of the experimental points in the factor space simplex-lattice Plan

Diagrams density, ash content and mechanical strength of wood pellets are built based on the results of the experiment on their compositional, which are presented in Fig. 3–5 respectively.

The maximum value of the index density of 1.59 g/cm³ is achieved when the content of pellets consisting of sawdust and bark in a ratio of 75 and 25%, respectively, as shown in diagram (Fig. 3). Simultaneous needles and bark content of over 50% in the composition of the pellet results in a sharp decrease of the density to 1.15 g/cm³.

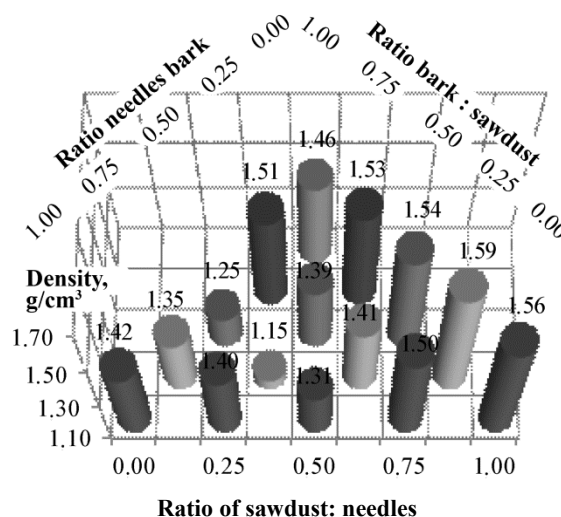


Fig. 3. Diagram of density pellets on their composition

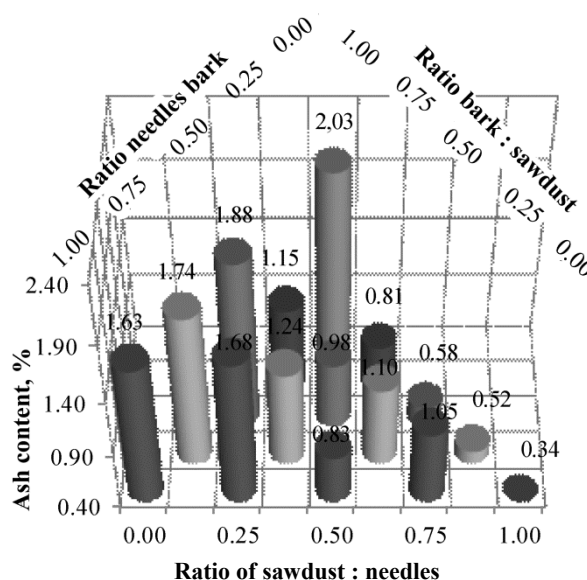


Fig. 4. Diagram of ash pellets on their composition

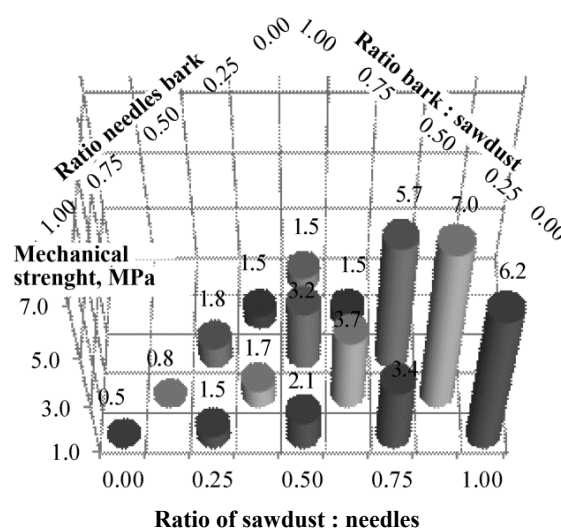


Fig. 5. Diagram of mechanical strength of pellets on their composition

The presence of the needles and bark pellets increases the ash produced by burning pellets, so it is necessary to limit the content of these waste wood ash to values that satisfy the requirements of STB 2027.

The presence in the composition of wood pellets needles reduces over 15% of their mechanical strength to 0.5 MPa and transport stability. Increasing the content in the composition bark pellets from 5 to 25% leads to an increase in mechanical strength – from 6.2 to 7.0 MPa, further increasing lobe leads to a reduction of its – 7 to 4.6 MPa. Therefore, from the viewpoint of mechanical properties of pellets is advantageous to maintain the composition in a bark content feedstock at 25%.

You must define a combination thereof, at which the best values of quality indicators given the complex and contradictory nature of the effect of each component on the properties of wood biomass pellets.

Found calculation of the generalized optimization criterion – $W = 0.95$ [4] the optimal composition of the pellets, as well as its corresponding indicators of quality. Found that the optimum content of the investigated components in the composition of the pellet sawdust – 70%, needles – 5% and bark – 25%. In this case, the best combination of values of quality pellets achieved density – 1.49 g / cm^3 , ash content – 0.42% and other mechanical ness – 6.5 MPa.

The experimental data were tested in an industrial environment through the issuance of an experimental batch of wood pellets containing bark of pellets that meet the requirements of both domestic (STB 2027) and European (DIN EN 14961-2)

standards. Bark perform the functions of the active filler with a highly specific surface area, which contributed to strengthening the adhesive interaction of wood particles and to achieve high dimensional stability of pellets.

Conclusion. The influence of the ratio of the components of woody biomass (sawdust, bark, pine needles) on the main indicators of the quality of pellets. Found that the optimum content of the investigated components in the pellets is sawdust – 70%, needles – 5% and bark– 25%. When this combination of the best indicators of the quality of pellets is achieved: density – 1.49 g / cm^3 , ash content – 0.42%, and the mechanical strength of – 6.5 MPa. The pilot batch of pellets is perfect, confirm the results of the research.

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