

Find the difference between the optimal strategy and the case when only one logging company operates, for example, company A (if  $p \leq q$ ). Then the optimal cost of extraction and delivery of 1 m<sup>3</sup> of wood is :

$$\frac{K}{4} \cdot \left( l^2 + \frac{m^2 (p - q)^2}{K^2} \right) + \frac{ml}{2} \cdot (p + q) - \frac{m}{2K} \cdot (p - q)^2.$$

And the delivery of 1 m<sup>3</sup> timber from point A is  $\frac{Kl^2}{2} + pml$ .

Thus, the economy will be:

$$\frac{K}{4} \cdot \left( l^2 - \frac{m^2 (p - q)^2}{K^2} \right) + \frac{ml}{2} \cdot (p - q) + \frac{m}{2K} \cdot (p - q)^2.$$

If the capacity is proportionally placed between enterprises A and B, then the forest strip will be processed in the shortest possible time. Issues of business management of agricultural enterprises are considered in [2].

The result of the research can be summarized as an arbitrary number of forests and logging companies. This will optimize the cost of logging and delivery of wood to logging factories.

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## DEVELOPMENT OF RESOURCE-SAVING TECHNOLOGIES FOR PROCESSING WOOD WASTE FOR THE PRODUCTION OF ALCOHOLIC BEVERAGES

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Waste reduction is a key challenge for the sustainable development of the food industry, so reducing it is a pressing issue for most businesses in the industry. Waste recycling and utilization is a strategic goal for each company, which involves the involvement of innovative technologies based on the evaluation of decisions in

reducing the cost of finished products, minimizing raw material losses, increasing the yield of finished products.

Despite the importance of this issue for the world community in the food industry, the connection between efficient resource-saving and environmental technologies of waste processing, disposal of by-products in the scientific literature is given limited attention.

One of the priority areas for alcoholic beverage and wine and cognac production is the production of crushed oak wood from pyrolyzed wood waste. The formation of pyrolyzed wood waste in the process of generating air-smoke mixture involves the use of wood chips of hardwoods – oak, which has a positive effect on the composition and concentration of smoking agents, reducing resin formation and increasing organoleptic characteristics [1, 2].

The aim of the work is to determine the prospects of pyrolyzed wood waste for the production of alcoholic beverages.

For pyrolysis we used technological chips of hardwood species – from oak wood of large fractions –  $(6 \times 12 \times 3) \cdot 10^{-3}$  m. The initial mass fraction of wood chips moisture before loading into the smoke generator was –  $W_1$  9.42 %. Before pyrolysis, the chips were further moistened with drinking water to a value of  $W_2$  49.08 % to ensure the relative humidity in the chamber  $W_3$  62% when smoking semi-smoked sausages.

Pyrolysis was performed at a temperature of  $T_3$  633 K for  $\tau_3$   $7.13 \cdot 60^2$  s. In the process of pyrolysis received pyrolyzed wood waste with a mass fraction of moisture ( $W_4$ ) 43.01 %, which was treated with an aqueous solution with a pH of 2.4 for  $\tau_4$  300 s, neutralized with an aqueous solution with a pH of 9.84 for ( $\tau_5$ ) 300 s, adjusted the pH with an aqueous solution with a pH of 6.91 for ( $\tau_6$ ) 300 s.

Drying of pyrolyzate with mass fraction of moisture  $W_5$  63.50 % during  $\tau_7$   $336 \cdot 60^2$  s outdoors ( $T_4$  295 K;  $W_6$  74 %;  $v_2$  1.5 m/s), and then in the oven at  $T_5$  373 K to the air-dry state with a mass fraction of moisture  $W_7$  of 6.58 %.

The obtained pyrolyzed wood waste is an intermediate product with the characteristics of wood chips and porous carbon material at the same time, therefore, we determine the fractional composition due to the mass fraction of residue on sieves with holes with diameter:  $d \geq 5.0 \cdot 10^{-3}$  m – 63.8 %;  $5.0 \cdot 10^{-3} > d \geq 3.6 \cdot 10^{-3}$  m – 20.8 %;  $3.6 \cdot 10^{-3} > d \geq 1.0 \cdot 10^{-3}$  m – 11.9 %;  $d < 1.0 \cdot 10^{-3}$  m (on the pallet) – 3.5 %. In the end, the working fraction of pyrolyzed wood waste with a diameter of  $d \geq 5.0 \cdot 10^{-3}$  – 63.8 % was selected.

Using the smallest particles – fractions with  $d < 1.0 \cdot 10^{-3}$  and  $3.6 \cdot 10^{-3} > d \geq 1.0 \cdot 10^{-3}$  in the technology of production of wine and cognac products, cognac, whiskey, calvados there are certain difficulties: dusty structure pyrolyzed particles complicate the filtration process, so it makes it impossible to use these fractions.

The use of medium fractions with a diameter of  $5.0 \cdot 10^{-3} > d \geq 3.6 \cdot 10^{-3}$  also makes it impossible to use these fractions, because in the structure of the pyrolyzed fraction of wood particles involved in the extraction – up to 10 %, while fully pyrolyzed particles involved in redox reactions and adsorption – up to 90 %.

The use of the largest particles – fractions with  $d \geq 5.0 \cdot 10^{-3}$  is promising in the technology of production of wine and cognac products, cognac, whiskey, calvados. In the structure of pyrolyzed wood chips involved in extraction – up to 60 %, with fully pyrolyzed particles involved in redox reactions and adsorption – up to 40 %. It should be used once, because after the first bookmark of wine and cognac products, cognac, whiskey, calvados, its surface layer is depleted of aromatic and phenolic substances, so further use of wood chips becomes inefficient.

Compared to traditional technology of aging wine and cognac products, cognac,

whiskey, calvados in oak containers or enameled tanks with oak rivets, as well as when using crushed oak wood in the form of clapboards, chips, shavings, which are used repeatedly, pyrolyzed chips can be used only as additional chips raw materials when separated from the main raw material.

**Conclusions.** Due to the use of pyrolyzed wood waste from  $d \geq 5.0 \cdot 10^{-3}$  m there is a reduction in the cost of alcoholic beverages. Thus, the method of production of pyrolyzed wood waste from oak, due to its single use, with minimal costs for raw materials and production, will intensify the maturation of wine and cognac products, cognac, whiskey, calvados, improve organoleptic characteristics and reduce their cost.

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## DIRECTIONS AND BASICS OF USING DIGITAL IMAGE DATA IN LASER SCANNING OF THE EARTH'S SURFACE

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**Abstract.** *In this article, the main directions of using digital image data in laser scanning of the Earth's surface, describes the processes of joint processing of images obtained with a digital camera and data from laser scanning of the Earth's surface.*

For the accuracy of the digital images to correspond to the accuracy of the terrestrial laser scanning data, it is necessary to place the scanning station at an acceptable distance from the imaging object.

This distance depends on the size of the array element and the focal length of the selected digital camera lens.[1, 2]

The main parameters affecting the number and quality of images taken simultaneously with laser scanning of the object using a digital camera are:

- matrix element size;
- the focal length of the lens;
- horizontal and vertical angles of the camera field of view;
- distance to the object.

To calculate the distance R from the digital camera installed on the scanner to the object, use the formula of the survey scale in a modified form with the specified detail, namely:

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