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THE THEORY AND PRACTICE OF GRAIN PRODUCTS COLD CONDITIONING TECHNOLOGY

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Abstract

This article describes the developed device and method for grain wetting. The wetting device uses a cold wetting method, which includes a vertically installed body, grain loading and unloading nozzles, a grain unloading device, and grain steaming components. The method utilizes sensors to detect grain moisture, electromagnetic valves for grain loading and unloading, and sensors to measure grain level and consumption. Compressed humid air flows through a vertical shaft with paddles, and the wetting process is controlled automatically.

Аннотация

В данной статье описаны разработанные устройство и способ увлажнения зерна. В устройстве для увлажнения используется метод холодного увлажнения, который включает вертикально установленный корпус, насадки для загрузки и выгрузки зерна, устройство для выгрузки зерна и компоненты для пропаривания зерна. В этом методе используются датчики для определения влажности зерна, электромагнитные клапаны для загрузки и выгрузки зерна, а также датчики для измерения уровня зерна и расхода. Сжатый влажный воздух подается через вертикальную шахту с лопастями, и процесс увлажнения контролируется автоматически.

Annotatsiya

Ushbu maqolada ishlab chiqilgan qurilma va donni namlash usuli tasvirlangan. Namlash moslamasi vertikal ravishda o'rnatilgan korpus, donni yuklash va tushirish qo'shimchalari, donni tushirish moslamasi va donni bug'lash komponentlarini o'z ichiga olgan sovuq namlash usulidan foydalanadi. Ushbu usul don namligini aniqlash uchun datchiklardan, donni yuklash va tushirish uchun solenoid klapanlardan va don darajasi va oqim tezligini o'lchash uchun

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sensorlardan foydalanadi. Siqilgan nam havo pichoqlar bilan vertikal mil orqali etkazib beriladi va namlash jarayoni avtomatik ravishda boshqariladi.

Keywords
grain cold wetting, wetting system, pressure, relative humidity indicators
Kalit so'zlar
Donni sovuq namlash, namlash tizimi, bosim, nisbiy namlik ko'rsatkichlari.
Ключевые слова
хранение зерна, система имен, давление, имена относительности,

Introduction

Wheat products are one of the crops that are extremely important in human nutrition. Bread products made from flour and flour are the main consumer products in many countries, including Uzbekistan. In order to ensure the safety of food in our country and optimize the production of quality bakery products, great attention is paid to improving the quality of flour. Cold grain conditioning technology plays an important role in achieving these goals.

Cold conditioning of cereals is an important factor in regulating the moisture content of wheat and improving the quality of cereals. This process allows you to preserve the vitamins and nutrients contained in the grain, reduce energy consumption and preserve the grain for the long term. Through cold conditioning, it is possible to increase the overall quality indicators of the product and ensure production efficiency. Therefore, in flour production enterprises, the technology of cold conditioning of grain is designated as one of the priority areas.

In the process of producing quality flour, it should be borne in mind several indicators that depend on the optimal result of flour.The amount of protein substances in it, their composition, state and properties are of the first degree of importance. The rheological properties of wheat dough, which determine its elasticity, plasticity and viscosity, are precisely related to the proteins of flour. The amount of protein in wheat grain can vary from 7% to 26%. The amount of proteins in the grain is associated with the properties of the wheat variety. But even in wheat of one variety, the amount of proteins can vary over a wide range according to soil-climatic, weather and agrotechnical conditions.

In flour production enterprises, it is considered important to make an optimal decision in the effective increase in grain moisture of cold grain conditioning, and the process is carried out in air conditioning devices. The conditioning process is updated and costs are reduced, with the grain husk in mind. Another important

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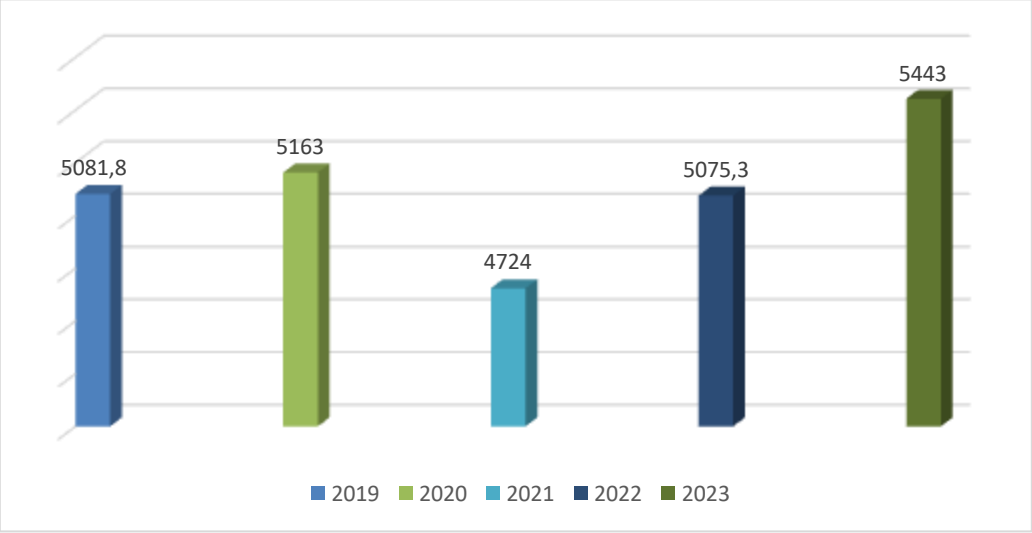
aspect of the air conditioning process is that it saves time and energy consumption when processing grain.

The purpose of modern humidification equipment is to reduce the time of cold conditioning of grain. It is based on increasing the rate of water penetration by generating high frequency vibration and reducing water surface tension. While lowering water surface tension increases the efficiency of water spreading to the grain mass and water penetration into the grain. This device does not spoil the grain, since it does not involve the cleaning process.

The main issue envisaged in the research work is to bring quality indicators in cereals to an optimal level with the help of cold conditioning of cereals, preserve vitamin substances in cereals, increase the amount of gluten and achieve a decrease in the amount of ash, which we considered on the example of the process of absorbing moisture into cereals of the flour production enterprise.

The grain is considered one of the most widely cultivated cereal plants in the world. Russia, China, Hinshiton, Kazakhstan, Ukraine, the Americas, Kyrgyzstan and other countries are now leading grain production in many countries. Including our country, the export potential for grain production and flour production among the peoples of Central Asia is growing in this regard.

Dynamics of the production of cereals



Methods:

This article carried out theoretical and Applied Research in order to assess the effectiveness of cold conditioning technology. Initially, the possibilities of optimizing the process were analyzed by studying the physical properties of wheat

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grains and the mechanisms of moisture transfer. The following important criteria were used in the mathematical modeling of the cold conditioning process:

1.Lukov will help in assessing the diffusion and conduction properties of moisture. This criterion is used in the study of how moisture in the grain spreads and how the material transfers moisture. It is used in the analysis of moisture permeability processes, and the formula for the effect of moisture on diffusion processes can be determined as follows:

$$L = \frac{D}{k} \qquad (1)$$

where: D is the moisture diffusion coefficient (m²/s), k is the moisture permeability coefficient (m²/s).

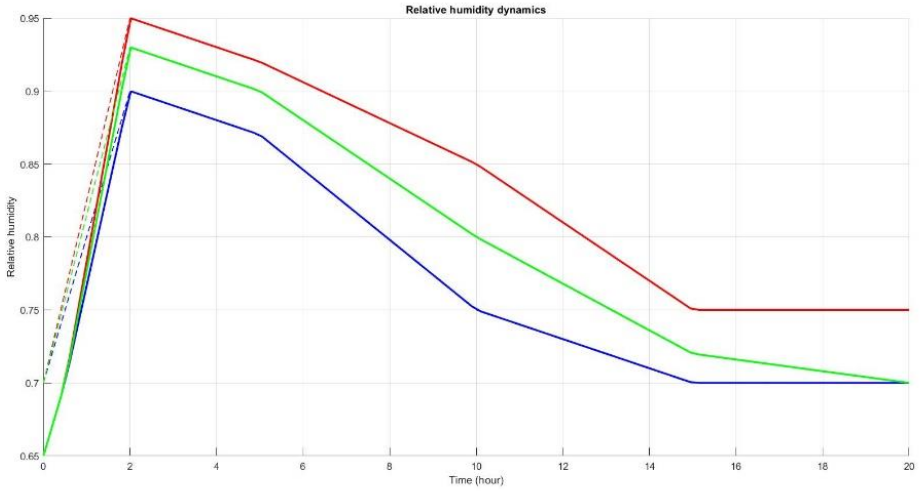

Figure 1. Dynamics of the relative humidity of the inter-grain space: Points-experience, lines-calculation

Thus, the proposed method-the device allows you to fully control the process of soaking the grain, ensure that the grain is mixed at the same level, quickly moisten the grain.

2.Mason's criterion: a criterion that is important in determining the rate at which moisture is released from wheat grain. With the help of high-frequency vibration technology, the spread of water on the grain surface and the speed of its propagation are increased.

$$Mo = \frac{D}{\lambda} \qquad (1)$$

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3.Biot criterion: used to measure the efficiency of moisture transfer with the external environment. In conditions of high temperatures and humidity, it is possible to ensure optimal moisture dissipation through this criterion.

The calculation of moisture permeability in the assessment of moisture exchange processes under the bi criterion is as follows:

$$Bi = \frac{hL}{k} \qquad (2)$$

4.Fo criterion: is the criterion necessary to control the spread of moisture over time, with which monitoring the effect of moisture on the grain surface and optimization through the model is carried out.

The FO criterion uses the following formula to analyze the time distribution of moisture permeability:

$$F_0 = \frac{\alpha\tau}{L^2} \qquad (3)$$

In the course of the study, the wheat sample was analyzed by controlling the temperature and humidity levels in the cold air conditioning apparatus. The process used mathematical models and physical equations using the Matlab program. As an object of research, samples of wheat from the Asaka "grain products" Enterprise were selected, in which moisture, gluten content, whiteness of flour and other quality indicators were assessed.

Results

According to the results of studies, the cold conditioning method allows you to maintain an optimal level of moisture and vitamin substances in cereals. The following results were observed:

1. Moisture distribution: moisture was evenly distributed over the inner layers of wheat grain, making it possible to increase the quality of the product. Uniform distribution of moisture in the inner layer ensures the efficiency of conditioning and reduces the change in product quality.

2. Energy saving: energy consumption has been reduced using cold air conditioning technology. This made it possible to increase the volume of production, while reducing the cost of products.

3. Whiteness and gluten content of flour: these indicators increased significantly after cold conditioning, resulting in an improved whiteness indicator and gluten content of flour.

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By optimizing the mechanism of moisture distribution, it was possible to improve the technological processes of production and improve the quality of products. For example, on the basis of water vapor condensation and diffusion processes, it was possible to use energy economically. Also, in the course of research, the hydrothermal state control system of grain was improved using a model developed in the Matlab program, which helps to maintain stable grain quality.

The initial moisture content of the grain is M_0 = 9% quenching rate $k = 0.05\ soat^{-1}$, and the moisture content equal to the medium is $M_{eq} = 35\%$. If the time is $t = 6$ hours, we calculate the change in the amount of moisture.

1. Moisture absorption equation:

$$\frac{dM}{dt} = 0.05\ (M - 0.35\ )$$

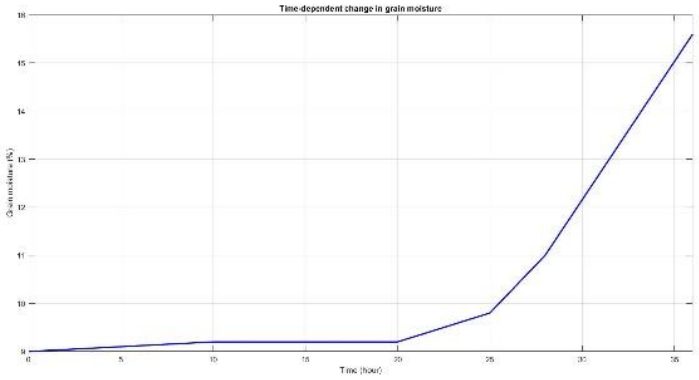
2.Calculation of the amount of moisture

To calculate the amount of moisture by time, we use the following equation:

$$M\ (t\ ) = M_{eq} = \ (\ M_0 - M_{eq}\ )\ e^{-kt}$$
$$M\ (t) = 0.3 + (\ 0.09 - 0.35)\ e^{-0.05*6}$$
$$M\ (t) = 0.3 - 0.26\ e^{-0.3}$$
$$e^{-0.3} \approx 0.7408$$
$$M\ (t\ ) = 0.35 - 0.26^{*}\ 0.7408$$
$$M\ (t\ ) = 0.35 - 0.19 = 0.16\ or\ 16\%$$

This means that after 6 hours have passed, the moisture content of the grain will be about 16%.

Research for the purpose of cold grain conditioning shows the following indicators: Figure A is an indicator of the previous method of grain conditioning, Figure B is an indicator of finding the optimal solution for grain conditioning as a result of research.



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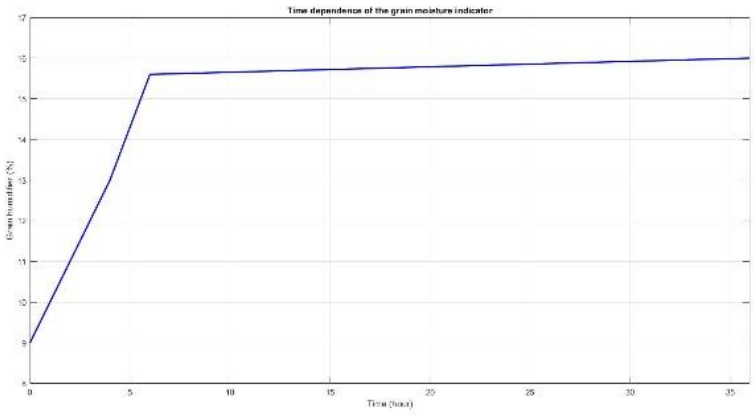

a) the current grain soaking method b) The New grain soaking method.

Discussion

Cold conditioning technology allows you to get a high-quality product in the production of flour. The results of the study show that through the conditioning of cereals, its quality indicators improve, and production efficiency increases. One of the main advantages of cold conditioning is the preservation of the nutritional and physico-chemical properties of the product in the process. This is instrumental in ensuring food safety.

In the process of cold conditioning grain, the quality of the product is controlled through moisture transfer and temperature permeability. In this, a hygrotermic balance between moisture and air in the grain is ensured, which guarantees long-term preservation of the product. Also, on the basis of the results obtained, the following technical proposals were developed:

1. Rapid moisture dissipation: allows you to improve the quality of the product by increasing the rate of water dispersion to the grain surface using high-frequency vibration technology.
2. Optimal temperature and humidity management: by controlling temperature and humidity in the conditioning process, the preservation of microminerals and vitamins in the product is ensured.
3. Innovative control systems: the use of innovative control systems in the cold air conditioning process, especially automated control methods, has a positive effect on improving product quality.

Conclusion

As a result of the studies described above, it can be said that it is possible to obtain high-quality flour and other products using the technology of cold conditioning of cereals. This technology has proven its priority in improving energy efficiency and product quality. Studies show that with the help of innovative technologies, it is possible to preserve the nutritional properties of the

product and improve quality indicators when conditioning cereals. In the future, there are opportunities to further improve the quality of products with the help of new built-in air conditioning devices.

The article analyzes the methods and devices of grain soaking, and as a result of the analysis, the device and method of grain soaking is developed and described. The device used a cold wetting method of grain wetting, and the wetting device also includes a vertically mounted body, grain loading and release cartridge, grain unloading device, and grain steaming. This method used grain moisture detection sensors, grain loading and release electromagnet valves, grain level and consumption measuring sensors. The device was made to carry wet air compressed from inside the vertical shafts and shovels. The grain soaking process is controlled and controlled through an automatic control system. The developed device and method allows you to fully control the grain soaking process, ensure that the grain is mixed at the same level, quickly moisten the grain.

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