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HYDROTHERMAL TREATMENT OF GRAINS IN FLOUR MILLING

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Abstract

In this article, the hydrothermal treatment of grain in mills and grain mills is carried out in complex humidifiers and steam dampers, as well as in complex machines and equipment with automatic control and adjustment systems. The impact of water and heat on the grain during hydrothermal treatment, as well as the parameters (parameters) that determine the mode of this process include: humidity, temperature, pressure and duration of the process.

Keywords: Mills, grain mills, hydrothermal treatment of grain, automatic control, adjustment, systems, complex machines and equipment, humidifiers, steam hoppers, technological scheme, grain properties, heat treatment, humidity, temperature, pressure.

Introduction

The main purpose of hydrothermal treatment in mills and grain mills is to maintain these properties in the same optimal way by changing the initial technological properties of the grain to a specified size with orientation [11].

The difference in the structural and mechanical properties of the endosperm and husks of grain coming into production is very small. Therefore, it is very difficult to separate them from each other, and the result in the processing of such grains will not be high. In hydrothermal treatment, an attempt is made mainly to increase the difference in the properties of the grain husk and the endosperm. In mills, the process is carried out in such a way that the strength of the endosperm is reduced and the strength of the shell is increased. In cereal plants, the opposite is done, that is, the strength of the core (endosperm) is increased, the strength of the shell is reduced. The more rapid this change is, the higher the efficiency of processing grain and obtaining flour and cereals. The degree of change in the technological properties of the grain is determined by the specific methods of hydrothermal treatment and the interaction of the grain with water [16].

The Main Part

Hydrothermal treatment of grain in mills and pulp mills is carried out in more simple machines and apparatus with automatic control and adjustment systems, as well as in simple humidifiers and dimming bunkers. All of these are linked through a technological scheme that determines the sequence of effects on the properties of the grain [17].

During hydrothermal treatment, the grain is exposed to water and heat. The dimensions (parameters) that determine the modes of this process include: humidity, temperature, pressure, and process time [12,18].

The following methods of hydrothermal treatment of grain are used in the mill:

1. In the method of cold air conditioning;
2. Accelerated air conditioning;
3. By hot air conditioning method

In the cold method, the grain is moistened with water at a temperature of 14-20 ° C and steamed in bunkers. The grain is not heated in this way.

In the accelerated method, the grain is evaporated with saturated steam and then washed in cold water.

In the method of hot air conditioning, the grain is moistened with cold water and heated in various heaters (ultrasound, high-frequency currents, infrared rays, etc.).

It is mandatory for these hydrothermal treatment methods to moisten the grain with an additional 0.3-0.5% and steam it for 20-40 minutes before sending it to the crusher (1st milling system to the roller machine). It is needed to moisten the upper shells of the grain (fruit and seed shells, aleyron layer), increases the elasticity of the shells, the shells do not crumble too much, forms large pieces of bran and is easily separated from it in the husks [19].

In the mills of the Republic of Uzbekistan, cold conditioning method of hydrothermal treatment of grain is used. This method is simple to set up and manage, but requires larger bunker volumes to steam the wetted grain [20].

Cold hydrothermal treatment of grain is carried out in the following order: the cleaned grain is processed in a wet grinding machine, additionally moistened and steamed. The highly transparent grain is moistened twice and steamed twice.

The approximate values of cold-water hydrothermal treatment regimes for wheat grains in wheat flour are given in Table 1.2.

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Indications of cold-water hydrothermal treatment regimes for wheat grains in the grinding of varietal flour are approximate, as each grain batch is characterized by a variety of initial properties and individual reactions to changes in humidity. In accordance with the rules of organization and conduct of technological processes in mills, the engineer-technologist must check the selected hydrothermal treatment regimes in the laboratory and in production by grinding flour [21].

Table 1. Estimated parameters of cold-water hydrothermal treatment regimes for wheat grains in flour milling

Wheat type	**Depending on the overall transparency (%) of the wheat димлаш вакти, соат**			**Moisture content of wheat sent to the threshing system,%**
	60	**60-40**	**40**	
I	**8-15**	**6-12**	**4-8**	**14,5-16,0**
II	**16-24**	**—**	**—**	**15,5-16,5**
III	**8-16**	**6-12**	**4-8**	**14,0-15,0**
IV	**16-20**	**12-16**	**6-12**	**15,0-16,5**

Processing of grain by the method of accelerated air conditioning is carried out in the following order: the grain is stored in a heat hopper for a few minutes after evaporation for a short time (20-40 seconds) in the evaporator ASK. The hot grain is then washed in cold water in a washing machine and sent to a dehumidifier. The grain is additionally moistened and sent to bunkers for steaming. If the initial moisture content of the grain is low, it is not necessary to send the grain to a moisture absorbing machine. The grain is then sent directly to the wetting machine. If no additional wetting of the grain is required, the wetting machine is removed from the circuit [18].

In the first method, steaming and drying of the grains results in an increase in the strength of the core and an increase in the brittleness of the husk. This is because the moisture content of the shell decreases more during drying and cooling. Evaporation of grains - in which the grain is simultaneously moistened and heated.

As moisture enters and heats the core, it becomes elastic, its brittleness decreases, and it breaks less to a lesser extent as a result of mechanical action during the separation process from the shell. Evaporation of grains is characterized by two indicators - vapor pressure and duration of evaporation. Also, the higher the vapor pressure and evaporation duration, the higher the grain will have higher humidity and temperature.

The choice of evaporation regimes depends on the very high technological properties of the grains. The increase in evaporation modes is due to the high vapor pressure and its high temperature (the higher the vapor pressure, the higher its temperature), as well as the longer the evaporation duration, which can lead to a deterioration in the quality of the extracted grain. Therefore, the upper limit of vapour pressure and evaporation duration is set.

Evaporation parameters have different effects on the technological properties of grains. Also, as the vapour pressure and evaporation time increase, the output of the broken core decreases and the separation efficiency of the buckwheat grain from the shell increases, so when it is given strict parameters, the vapor pressure is mainly 0.30 MPa (at such a vapour pressure its temperature is 143 ° C) and exposure time. - 5 minutes. Very high parameters of steam treatment worsen the consumer properties of cereals [12].

For oats, the efficiency of processing depends on the parameters of hydrothermal treatment. Good results are obtained when oat grains are steamed for 3-5 minutes at a vapor pressure of 0.05-0.10 MPa. Very high evaporation parameters do not lead to good results when used. When the evaporation parameters of rice grain are affected, its technological properties differ from those described above.

The grains are evaporated in evaporators under continuous and intermittent action. Continuous-action evaporators - auger horizontal, compact, simple design, no need to install bunkers before and after the apparatus. The grains are evaporated evenly, which is its advantage, as it also constantly mixes the grain during processing. Their disadvantages are that high pressure cannot be created in the working chamber, and the evaporation duration cannot be adjusted. One of the best ways to do this is to create a pressure of 0.03-0.05 MPa.

Two- and four-tier evaporators are being manufactured abroad to increase grain processing time. Multi-tiered evaporators are installed in series to increase the vapor pressure. It is possible to create a very high pressure in the evaporators located in the center, as well as the whole device helps to increase the duration of processing.

Intermittent A9-BPB evaporators have no defects. The grains can also be processed at any set pressure, the evaporation duration being controlled. The evaporation process from the control panel is performed automatically. The maximum duration of the cycle is 8 minutes.

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Drying of grains. This is one of the main processes of hydrothermal treatment of grains. In this case, for further processing, the grains are displayed until the optimum humidity set in the standards.

The drying process not only reduces the moisture content of the grain, but also accelerates the regeneration of the structural-mechanical properties of the kernels and husks. As a result of drying of the husks on the surface of the grain, which has a large capillary structure, it releases moisture relatively lightly. The grain core retains moisture very tightly, dries more slowly, so during the drying process, a crust and core are formed at different humidity levels. The moisture content of the shells is very low (3-8%) relative to the core. Dry husks are very brittle, when the husk separates, it splits slightly and separates from the kernel, while those with high enough moisture remain in an elastic state and break less when the grain is mechanically affected. Not only does the brittleness of the shell increase as a result of the decrease in moisture, but also the brittleness of the shell increases with partial cracking during dehumidification.

Due to the nature of the hydrothermal treatment process, a type of dryer designed for quick drying of grains will be required. Cooling of grains. After drying, the hot grain is cooled in special cooling columns or in air separators in a non-closed air cycle. Sometimes they are cooled when they are lifted by a pneumatic transport and the grains are transported. The cooling process is used to reduce the subsequent moisture content of the grains. During the cooling process, the brittleness of the husk also increases, resulting in a decrease in their temperature and humidity, which also occurs in the core at the same time, so in some grain mills the grains are not cooled, they are recycled with heat at a temperature of 35 - 40 ℃ [22].

The second method. This method involves two processes: wetting (evaporation) and steaming.

Wetting of grains. In flour mills, grain is moistened in humidifiers. After rapid wetting, water collects in the grain shells, their capillaries are filled, and then they begin to enter the core. The grains transferred to the hoppers for steaming are mixed with water using augers, given that the water cannot be transferred evenly, the process of wetting the grains is very short, it takes a few 10 seconds.

By moistening the shells of the grains, it becomes somewhat softer, and as moisture passes into the outer layer of the endosperm, its contact with the shell is loosened. It is also easy to separate the husk by hydrothermal treatment of corn grains. When the grain is crushed, the brittleness remains intact, its connection with the endosperm diminishes.

Conclusion

Steam the grains. As a result of the passage of moisture into the spaces between the grain shells and kernels, as the grain components rise in an uneven manner, the layers of the husks occur, leading to softening of the outer layers of the kernels and husks. This is due to short-term dimming. In all cases, the duration of grain soaking does not exceed 2-3 hours.

In the first method, the hydrothermal treatment regimes are determined by the following parameters: vapour pressure and evaporation duration, final moisture content of the final grain after processing. Indications for the second method of processing: the final moisture content of the grain, the duration of their steaming. Humidification under laboratory conditions is carried out in a cold method by moistening the grain with water at a temperature of 14-20 ° C and steaming in cans.

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