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STUDYING THE INFLUENCE OF THE HEATING TEMPERATURE OF THE DRYING SHELL DRUM FOR THE DRYING PROCESS OF RAW COTTON

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Annotation

The test was carried out according to the technological regulations for processing raw cotton (MPKI-30-2012). The mode of operation of the dryer was selected in accordance with the regulations, depending on the initial humidity, the drying was carried out at the heating temperature of the drum shell t = 25-40-55-70 ° C. Before the experiment, the time required to heat the drum shell was determined. The tests were carried out on raw cotton of the breeding variety An-Bayavut 3, III industrial grade with an initial humidity of 10.5 to 22.3%.

Keywords: pty, dryer, Paytug, way, generator, heat and mass transfer, pipeline, drying plant.

Introduction

To determine the heating efficiency of the drying drum shell, an experimental study was conducted at the Paitug cotton Gin plant.

The following changes were made at the existing 2SB-10 drying unit at the Paytug Cotton Gin Plant. The surface of the drying drum is covered with a special heat-insulating casing, the mesh part of the drum is sheathed with sheet steel, the front part of the 1 meter drum is made of mesh.

The general view of the drying plant operating at the Paytug cotton mill is shown in Fig. 1, and the flow diagram of the coolant in Fig.2.

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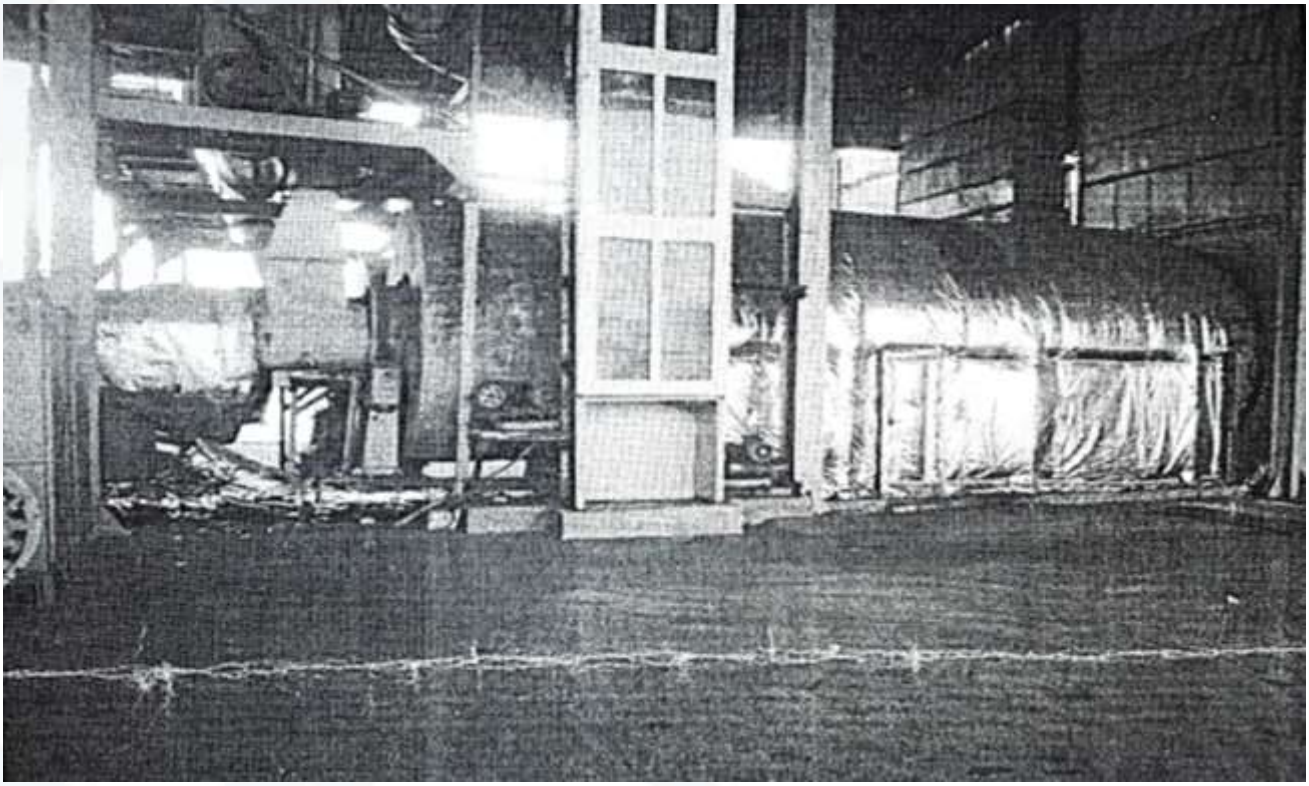
The dryer works as follows:

From the heat generator through pipelines 1 and 2, a coolant with a volume of up to 10000 m3/ h is supplied, respectively, to the dryer and the air chamber. The coolant entering the air chamber washes and heats the drum shells, and then enters the drum through the mesh surface 8. The coolant entering through the pipeline 1 prevents the accumulation of raw cotton in the front of the drum.

When the drum rotates between the raw cotton and the coolant and the drum shell, heat and mass exchange occurs, the cotton is dried, the spent coolant goes into the atmosphere through the pipeline 6.

The test was carried out according to the technological regulations for processing raw cotton (PDI-30-2012). The mode of operation of the dryer was selected in accordance with the regulations, depending on the initial humidity, the drying was carried out at the heating temperature of the drum shell t = 25-40-55-70 ° C. Before the experiment, the time required to heat the drum shell was determined. The tests were carried out on raw cotton of the breeding variety An-Bayavut 3, III industrial grade with an initial humidity of 10.5 to 22.3%.



Drying plant
Image

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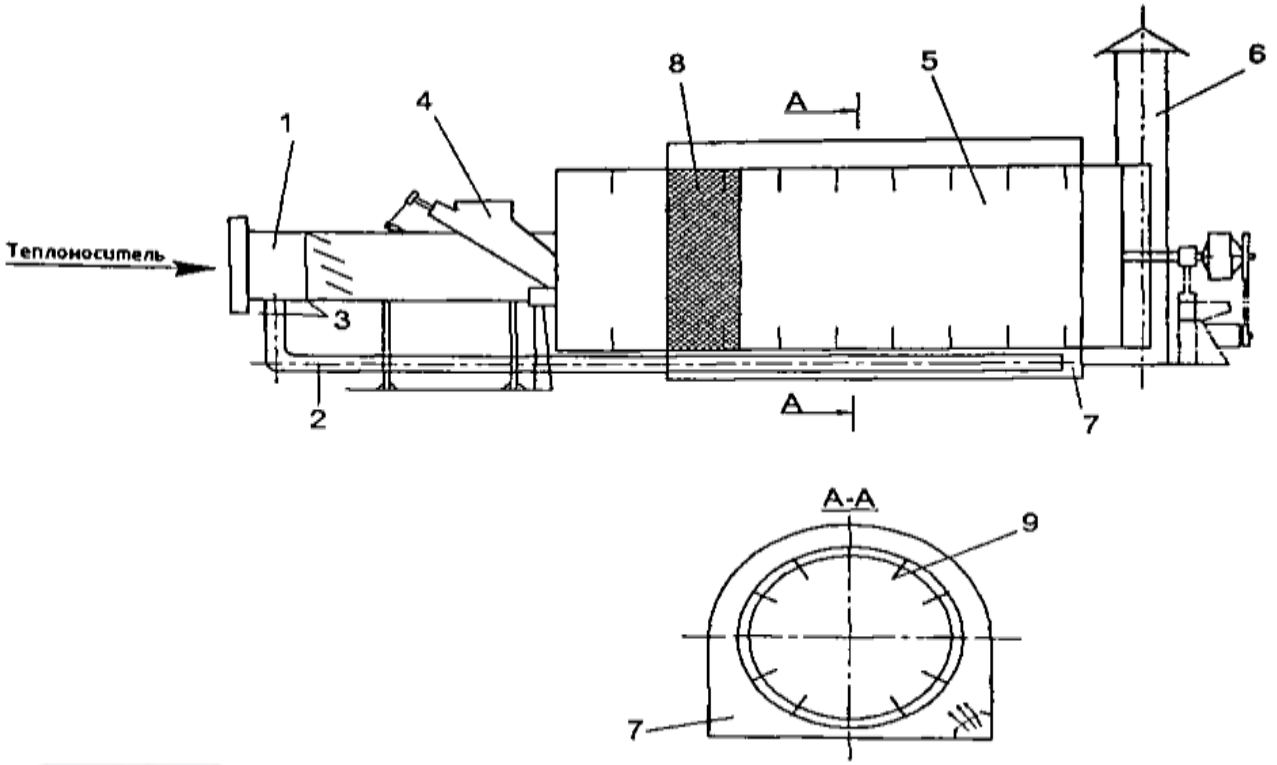

Figure 5.3.2. The flow diagram of the coolant. 1-pipeline for the supply of the main coolant, 2-pipeline for the supply of coolant to the air chamber, 3-flaps, 4-tray for the supply of raw cotton, 5-drying drum, 6-exhaust air pipeline, 7-air chamber, 8-mesh part of the drum, 9-longitudinal blades.

To measure the temperature of the internal devices of the dryer, a KSP -4 potentiometer with flat chromel-copel thermocouples, such as THK, was used. The humidity of raw cotton was determined in a drying cabinet Uz-8m.

To study the changes in fiber quality depending on the drying intensity in drum dryers, modern research methods were applied using effective methods and devices for processing the results obtained.

Fiber quality assessment after the technological process (drying, cleaning, gining), according to all indicators, was carried out in the laboratory of the Paytug cotton gin plant and in the testing laboratory of the Sifat association.

The content of the mass fraction of defects and weed impurities of the fiber was determined by manual analysis by fractions according to the standard method.

To conduct and process the results of the experiment, the method of mathematical planning of the experiment was standardized. For our research, the method of a complete factorial experiment of the PFE-23 type was chosen

Processing of the experimental data obtained showed that the most significant factors that have a noticeable effect on the quality and performance of the dryer

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are: - coolant temperature, coolant flow, dryer performance for raw cotton, the initial moisture content of raw cotton and the heating temperature of the drum shell. In this regard, the following factors were selected for further experimental research: the initial moisture content of raw cotton, the performance of the dryer for wet raw cotton and the heating temperature of the drum shell.

The technological regulations recommend a coolant flow rate of 18-22 thousand m/h, depending on the initial moisture content of raw cotton. Based on this, in experimental studies, the coolant flow rate was assumed to be constant, the average value of which is 20 thousand m'/ h.

The temperature of the drying agent was selected depending on the initial humidity of raw cotton in the range from 130 ° to 190 ° C.

In the table l. the levels of factors included in the experiment plan are given.

The moisture content of raw cotton after drying and the content of the mass fraction of defects and weed impurities of the fiber were taken as the output parameters of the experiment.

Table 1.

Designations	Name of the factor	Levels of variation		
		-1	0	+1
X_1	Initial moisture content of raw cotton, %	10,1	16,3	22,5
X_2	Dryer capacity, t/h	3,5	6,75	10,0
X_3	Heating temperature of the drum shell, °C	35	52,5	70

The planning matrix with a randomized order of experiments is presented in

Table 2. Experiment planning matrix

n/a	Order of implementation Experience			Factors		
				W ex %	P t/h	Tb °S
1.	13	24	12	10,1	3,5	35
2.	4	19	14	22,5	3,5	35
3.	3	9	22	10,1	10	35
4.	23	5	1	22,5	10	35
5.	15	7	20	10,1	3,5	70
6.	18	21	17	22,5	3,5	70
7.	8	10	6	10,1	10	70
8.	16	2	11	22,5	10	70

The hypothesis of the uniformity of variance estimates was tested by the Kohren criterion, and the hypothesis of the significance of regression coefficients by the Student's criterion. Fischer's criteria were used to test the hypothesis of adequacy. The experiments were carried out according to the accepted planning matrix (PFE 23).

The drying drum was heated using a coolant supplied to the space between the drum and the casing. After reaching the required temperature, at the same time, a drying agent and raw cotton were fed into the drum and samples were taken after 10 minutes after the dryer.

By processing the results of the studies on a computer, regression equations were obtained

$y1= 12.8+4.75x1+1.15 x2 +0.85 x3-0.37 x1x3$

$y2=5.62+0.51x1+0.3 1x2-0.11 x3;$

The obtained regression equations are checked for adequacy according to the Fisher criterion.

The analysis of the equations shows that the heating temperature of the drum shell significantly affects the intensity of the drying process.

Calculations have shown that at minimum values of x1 and x2, the moisture content of raw cotton after drying at values of x3 from -1 to +1 ranges from 7.38% to 6.42%, i.e. with an increase in the temperature of the drum shell from 35 to 70 ° C, moisture sampling will be greater by 0.98%, at maximum values of factors x1 and x2, respectively, it will be 19.92 and 17.8, i.e. moisture sampling will be greater by 2.44%, the content of defects and fiber clogging will be 0.28% less.

This shows the need to organize the drying of raw cotton with the maximum possible heating temperature of the drying drum and the correctness of theoretical calculations showing a significant amount of heat received by raw cotton from the heated internal device of the dryer.

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