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EXPERIMENTAL STUDIES ON THE INFLUENCE OF THE INITIAL TEMPERATURE OF COTTON ON FIBER QUALITY INDICATORS

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Abstract
In the article, the effect of color on fiber quality indicators and tensile strength during artificial drying of cotton at different temperatures was studied. A reasonable way to preserve the color of the fiber is recommended.

Keywords: Drying agent, mechanical damage, modal and staple length, fiber twist, fiber damage, fiber moisture, fiber moisture spot color, cotton drying time.

Introduction

Scientists of "Cotton Industry Scientific Center" JSC and TTESI [1, 2, 3] studied the influence of various factors on changes in the quality indicators of fibers and seeds during drying, in particular: the temperature of the drying agent, the initial moisture content of cotton before drying, the number of drying (kratnost) and others. They recommended rational parameters and procedures for drying cotton. However, with the transition to the world standard, there was a need to further increase the requirement to maintain the main physical-mechanical and technological properties of the fiber at all stages of cotton processing. It is known that the world standards pay special attention and requirements to the appearance and natural color of the fiber.

It is known that in all processes of cotton processing, including drying, mechanical damage to the fiber increases. The drying process has the most important effect on mechanical damage, durability (prochnost), modal and staple length, twist (izvistost), chemical and biological composition, fiber color, etc.

Based on the above, a number of experiments were conducted in order to study the effect of the drying process on the quality parameters of the fiber. Experiments were conducted at initial temperatures of air and cotton of 0 °C and 20 °C, drying temperatures of 100 °C and 200 °C, drying time 8 min. was held in the scientific-

research laboratory of the Department of Cotton Processing. For the object of research, a cotton sample of the second industrial variety, obtained from the An-Bayaut selection variety, was taken from machine picking, with the initial moisture content of W=10.54% and 18.9%.

The sample with an initial temperature of 0°C, humidity of 10, 54% and 18.9% was placed in a special refrigerator and kept until it reached the specified temperature [2,3].

The dried samples were placed on special racks after every minute and kept for a day so that all samples had the same equilibrium moisture content. Then the samples were passed through the laboratory cleaners in the working order of the cleaners in the production, after which the quality indicators of the cotton fiber were determined.

For example: cotton moisture content is 10.54% and drying agent temperature is 100°C, fiber damage increases by 6.0-7.0% when dried for 8 minutes, moisture content is 18.90% and drying agent temperature is 100°C, and from 8 minutes then 7.0-8.0% increase in fiber damage was observed, i.e., 1.0-2.0% more damage than cotton moisture content of 10.54%.

A change in the initial temperature of the cotton does not lead to a significant change in quality indicators during further processing. For example: the moisture content of the cotton is 10.54% and the initial temperature of the drying agent is 100°C, and the fiber damage is 9.0% and 10.0%, respectively (at the initial temperature of the cotton at 20 and 0 °C) at a drying time of 8 minutes [4,5]. It is known from Tables 1 and 2 that with the increase of drying time, the external appearance of the fiber - that is, the color - changes, for example: if the moisture content of the cotton is 10.54% and the temperature of the drying agent is 100 °C, after 2 minutes of drying, the color of the cotton fiber is from mottled to mottled and 4 after a minute it changes to yellow. The analysis shows that the color change of the fiber occurs after the heating temperature of the fiber reaches 65-70 °C and above.

As mentioned above, one of the main quality indicators of fiber is its breaking strength.

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Table 1 Dependence of fiber quality parameters on drying time W=10.54%; t=100 °S

Initial temperature of cotton, oS	Quality indicators	Duration of drying, min								
		0	1,0	2,0	3,0	4,0	5,0	6,0	7,0	8,0
20	Cotton moisture, %	10,54	8,2	6,85	6,30	5,66	5,04	4,75	4,40	4,11
	Fiber moisture, %	7,85	5,40	3,93	3,52	3,20	3,00	2,71	2,54	2,32
	Fiber temperature, %	20	52	74	81	89	94	96	98	98
	Mechanical damage,%	3,0	4,0	5,0	6,0	7,0	8,0	9,0	9,0	9,0
	The color of the cotton	wet spot	wet spot	spotted	spotted	spotted	spotted	spotted	spotted	spotted
0	Cotton moisture, %	10,54	8,86	7,90	7,10	6,58	6,01	5,70	5,42	5,26
	Fiber moisture, %	8,10	6,21	4,45	4,01	3,72	3,54	3,20	3,01	2,91
	Fiber temperature, %	0	45	69	77	84	90	94	98	98
	Mechanical damage,%	3,0	5,0	5,0	6,0	7,0	7,0	8,0	9,0	10,0
	The color of the cotton	wet spot	wet spot	spotted	spotted	spotted	spotted	spotted	spotted	spotted

Table 2 Dependence of fiber quality parameters on drying time W=10.54%; t= 200 °S

Initial temperature of cotton, oS	Quality indicators	Duration of drying, min								
		0	1,0	2,0	3,0	4,0	5,0	6,0	7,0	8,0
20	Cotton moisture, %	10,54	7,02	4,91	4,01	3,34	2,60	2,20	1,60	1,18
	Fiber moisture, %	7,85	4,34	2,66	2,34	2,18	1,90	1,52	1,30	1,01
	Fiber temperature, %	20	90	140	150	150	150	150	150	150
	Mechanical damage,%	3,0	5,0	7,0	9,0	10,0	11,0	11,0	12,0	14,0
	The color of the cotton	wet spot	wet spot	spotted	spotted	spotted	spotted	spotted	spotted	spotted
0	Cotton moisture, %	10,54	7,48	5,01	4,42	3,52	2,95	2.6	2,21	1,90
	Fiber moisture, %	8,10	4,76	3,05	2,52	2,24	2,01	1,64	1,30	1,02
	Fiber temperature, %	0	76	118	135	150	150	150	150	150
	Mechanical damage,%	3,0	6,0	8,0	9,0	10,0	10,0	11,0	13,0	15,0
	The color of the cotton	wet spot	wet spot	spotted	spotted	spotted	spotted	spotted	spotted	spotted

Figure 1 shows the dependence of the tensile strength of the second industrial grade An-Bayaut selection variety with initial moisture W=10.54% and W=18.90% on temperature and duration of drying (Fig. 1a) and b)). Curves 1^1-2^1 in the diagram Curves 1-2 were obtained at an initial drying temperature of 00C, while curves 1-2 were obtained at an initial drying temperature of 200C. Curves 1-1^1 were obtained during the drying process for 8 minutes at a constant temperature of T =100 °C, 2-2^1 for a drying duration of 8 minutes, but at a constant temperature of T-200 °C.

It can be seen that the strength of the fiber depends on all the considered factors - humidity, the initial temperature of the cotton and the current drying temperature.

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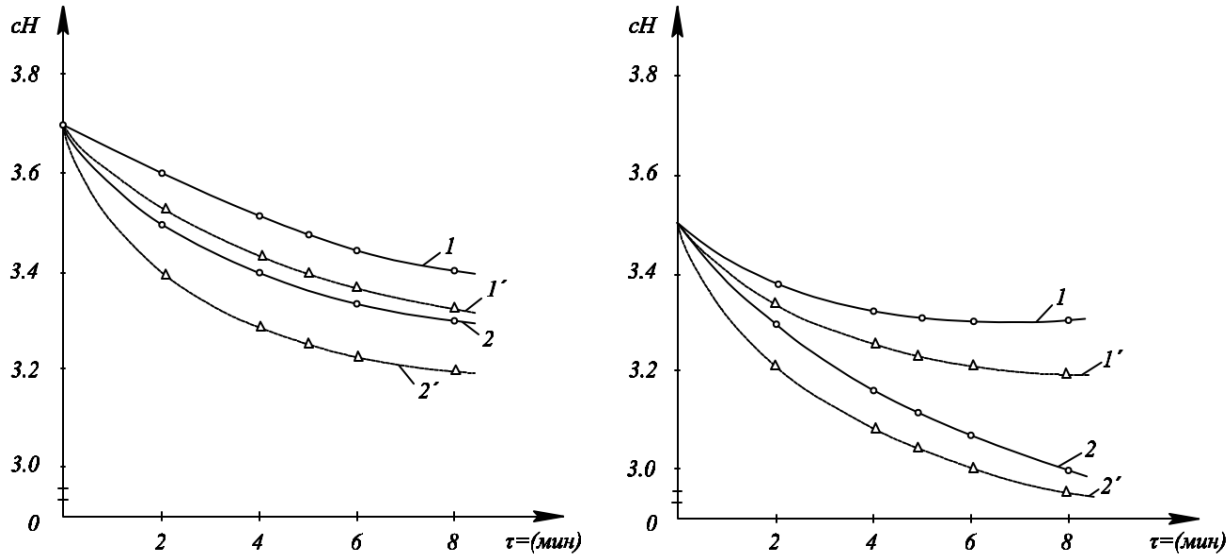

a) W=10.54% b) W=18.9%

1.1¹ Initial temperature of cotton when -T=100 °C

20 and 0 °C respectively

2.2¹ - initial temperature of cotton when T=200 °C

20 and 0 °C respectively

Figure 1. Relative tensile strength kinetics of fiber

When drying cotton with an initial moisture content of W=10.54% and a temperature of 20°C at a constant temperature of 100°C for 8 minutes, the fiber strength decreases by 0.23-0.3 G/tex, while cotton with an initial temperature of 0 °C - 0.3- By 0.37 G/tex, that is, the decrease in fiber strength in the second case (at the initial drying temperature of 0 °C) than in the first case (at the initial drying temperature of 20 °C) by 0.5-0.8 G/tex (comparing curves 1¹ and 1) will be more.

When drying cotton with an initial temperature of 0 °C at a drying temperature of 200 °C, the fiber strength decreases by 0.35-0.4 Gs/tex, and at an initial temperature of 20 °C by 0.3-0.35 Gs/tex (a) figure, 2 and 2¹ curve comparison). Changing the drying temperature of cotton with initial moisture W = 10.54% from 100 °C to 200 °C leads to a decrease in fiber strength by 1-1.2 G/tex (Fig. 1 a, curves 1 vs. 1¹ and 2 vs. 2¹, respectively comparing lines).

A similar situation is observed when cotton has an initial moisture content of W=18.90%, but in this case, the decrease in fiber strength at 100 °C (curves 1 and 1¹ and 200 °C, curves 2 and 2¹) is greater than that of cotton with an initial moisture content of W=10.54% It was found to be more than 0.3-0.6 G/tex.

The initial temperature of the cotton raw material does not significantly affect the color change of the fiber. But further increase in temperature and duration of drying will significantly change the color of the fiber than increasing the efficiency of the

dryer. The results showed that the most reasonable way to preserve the color of the fiber is to heat the fiber to 65-70 °C.

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