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MOISTURE DISTRIBUTION DURING THE COTTON RAW MATERIAL DRYING PROCESS

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Abstract:
In modern technologies, which are currently used in this article, the moisture content of cotton in the drying process is of great importance. At this point in the drying process, scientific research on the distribution of its moisture, the results of which are reflected.

Keywords:
Moisture, relative humidity, moisture distribution, film, Wet maggot, soot moisture, soot moisture.

Introduction

Depending on the relative humidity of the ambient air, the cotton raw material is either moistened or dried. The general classification of the moisture content of cotton raw material does not reflect the moisture content of its individual components. The distribution of moisture between the components of the cotton raw material and the relationship with them play an important role in the quality of the drying process and its intensive (intensive) progress.

Oil-coated fiber is unable to absorb or release moisture through its surface because this sheath is physically and chemically inert to water. In precipitation or condensation of water in air, moisture from saturated air becomes spherical, reaching the outer surface of the fiber in a liquid capillary state. It neither absorbs the fiber nor flows out of it. A small part of such moisture is retained in cotton fibers due to surface tension in the form of a film between individual fibers. At this time, the moisture change in the fiber becomes evident as it is in direct contact with moist air, and then partially protected by the fiber layer from air and relatively slow in the seed bed, while the direct seed coat is not in contact with air.

According to the research, there is a clear relationship in moisture distribution of cotton raw material components established, and the moisture distribution of cotton raw material that does not dry evenly after drying occurs in this relationship. Keeping this in mind, he proposed the following empirical equation defining the relationship of W_m -moisture magnesium, W_f -fiber and W_c -cotton with W-moisture of cotton raw material.

$$W_m=0{,}46W^{1{,}275};\quad W_f=0{,}7\ W;\quad W_c=\frac{W-P_m W_f - P_m W_m}{P_m}$$

Where: P_f and P_m- fiber and magnesium content in the absolute mass of cotton raw material; P_m- cotton bark ingredient,

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$$P_m = 1 - P_m - \mathrm{P}_m$$

The proportional increase in fiber moisture content with increasing moisture content of cotton raw material can be seen in Fig.1.

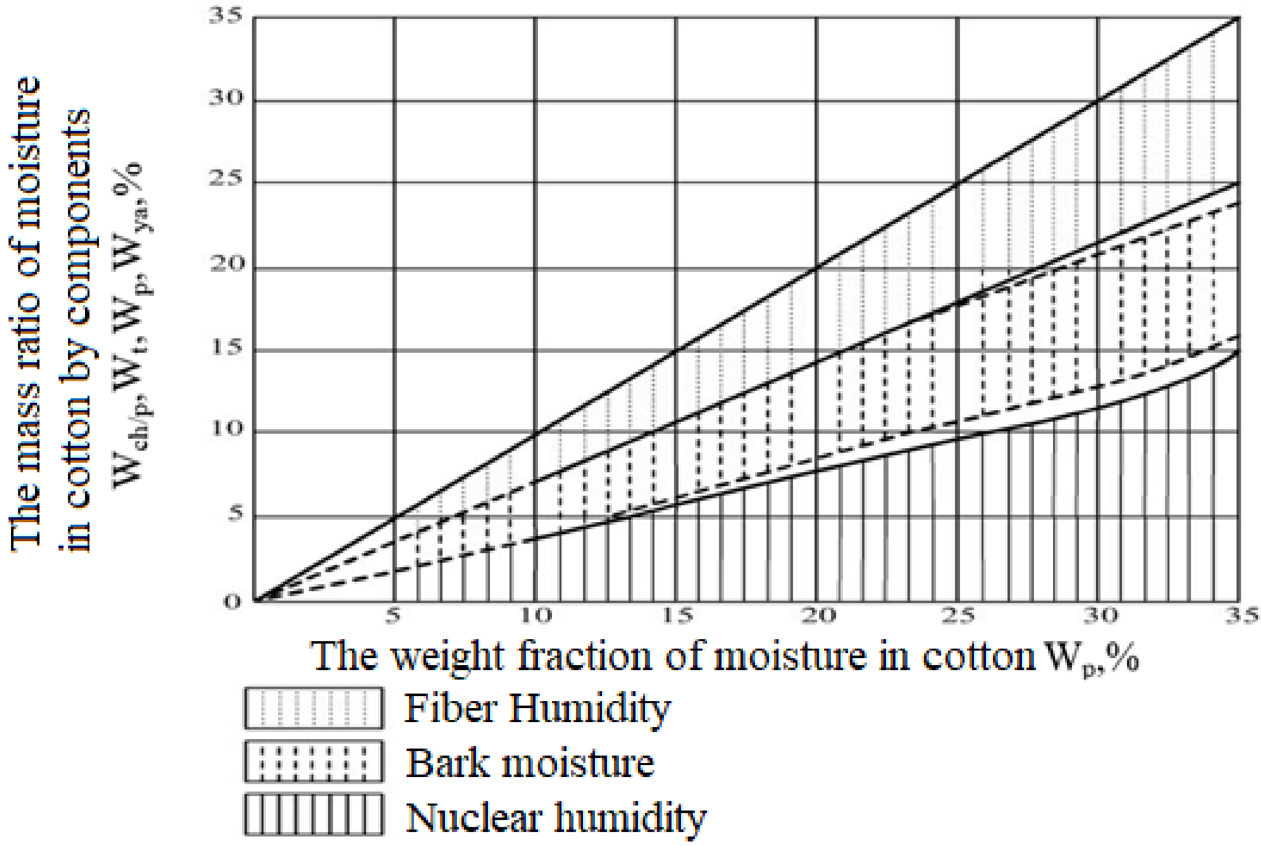

Fig.1. Moisture distribution among the components of cotton raw material.

A basin made of wood fabric consists of capillary-perforated colloidal bodies, and cotton raw materials with low humidity retain moisture in themselves and have a higher humidity compared to fiber and core. This means that when the moisture content of cotton raw materials is less than 35%, the moisture content of the core is less than the humidity of the pelvis. But the property of pelvic moisture saturation and core moisture increases rapidly when the moisture content of cotton raw materials becomes higher. Alternatively, the fiber and pelvis rod have slightly wider bulge boundaries compared to it.

Knowing the fiber moisture ratio, it is possible to determine the distribution of fiber moisture across all core varieties and their components in cotton seeds. A comparison of the moisture content of the components of cotton raw materials for grades I and IV showed that the moisture content in them due to the moisture of the fiber and core is higher than in grades I and less than in grades I.

The moisture content of the components at any point is allocated in the same way as the moisture content of cotton raw materials, which shows that they receive from each other, as shown in Fig.1. For this reason, it is necessary to look into the morphological and physico-mechanical properties of the material.

After all, uniform humidity of cotton raw materials, fiber and seed exists only if the humidity of the components is infinitely close to zero, then in all others it will be different.

With increased humidity of cotton raw materials, the difference between cotton raw materials and its components increases. Both components (fiber and germ) have different properties for saturation and release of moisture, while the germ is most active, the location of the bands indicates their humidity. The moisture distribution between fiber and seed in cotton raw materials, the inverse dependence of the relative humidity of cotton raw materials and fiber, established by experiment, d.x. as the humidity of cotton raw materials increases, the relative humidity of the fiber decreases.

Knowing the moisture distribution between the components of cotton raw materials, it is possible to determine an important indicator of drying - its evenness. To do this, the amount of evenly distributed moisture of cotton raw materials is compared before and after drying. The best drying process is if R = 1. Uniform drying is calculated using the formula:

$$P = \frac{W_f}{0{,}7W} \; or \; P = \frac{W_c}{0{,}46W^{1{,}275}}$$

Cotton raw materials have significant hygroscopicity, therefore, uneven humidity in its components leads to drying of the fiber, and high seed moisture leads to a decrease in drying efficiency, since during storage the fiber absorbs moisture from the environment. The hygroscopicity of cotton raw materials seriously affects cotton processing and fiber quality.

Due to the fact that the specific surface area of the fiber is larger than the specific surface area of the seed, uneven moisture separation occurs. As a result, during the processing of cotton raw materials, excessively dried fiber breaks down during cleaning and polishing, and wet seeds are damaged, which affects the quality of the product. Thus, ensuring uniform moisture content of cotton raw materials components is an important factor in the operation of the dryer.

Seed cotton consists mainly of fibers as well as seeds. The fiber is coated with a thin waxy substance, which contains mainly cellulose and a small amount of pectin. On the other hand, the family consists of the cornea and the surrounding cortex.

The fact that fiber and seed are multicomponent also affects its drying. If you dry cotton and its components at a certain temperature and monitor the relative humidity in them, the following graphs are obtained:

The relationship between the balanced moisture content of cotton components and the relative humidity of the air at a temperature of 300 K is shown in Fig.2.

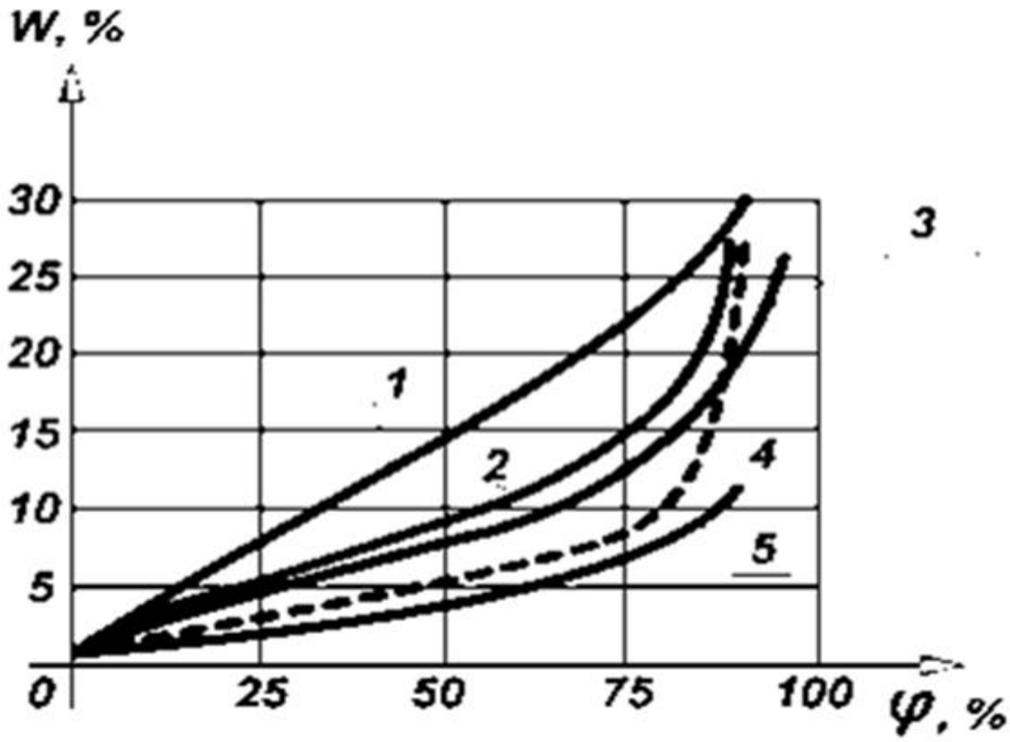

Fig.2. Relative humidity-dependent change in humidity balance in cotton components: 1-seed bark; 2-seed bark; 3-cotton; 4-seed bark; 5-fiber

The process of absorption of moisture from the air by dry cotton and its components over time at relative humidity = 40% and temperature T = 3000K is shown in Fig.3.

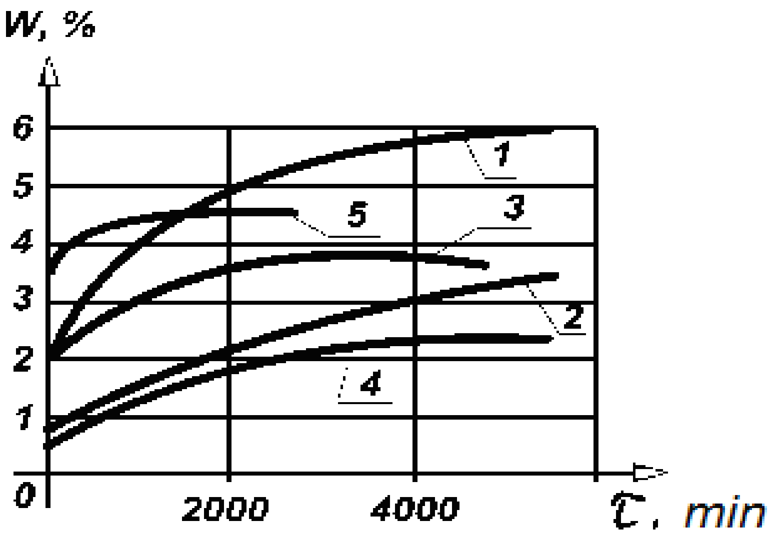

Fig.3. T=300 K and φ=40%. the change in moisture content of cotton components over time as a result of absorption from the air: 1-cotton husk; 2-cotton; 3-cotton; 4-magnesium cotton; 5-fiber.

From them it can be seen that the moisture balance is achieved first in the fiber, and then in the seeds.

The fact that this is also reflected in the rate of cotton buildup and its components is shown in Fig.4.

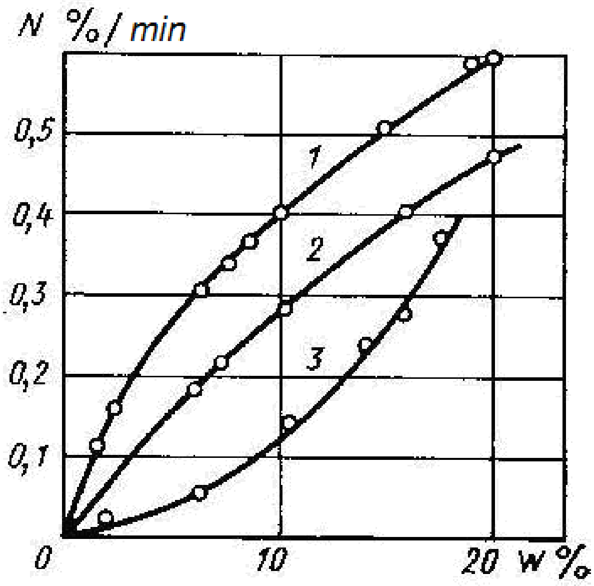

Fig.4. Graphs of cotton assembly and its components:
1 - fiber; 2 - cotton with seeds; 3-family.

From this it can be seen that the fiber dries the fastest. the sowing material is the slowest, and the rate of cotton growth from seeds is average.

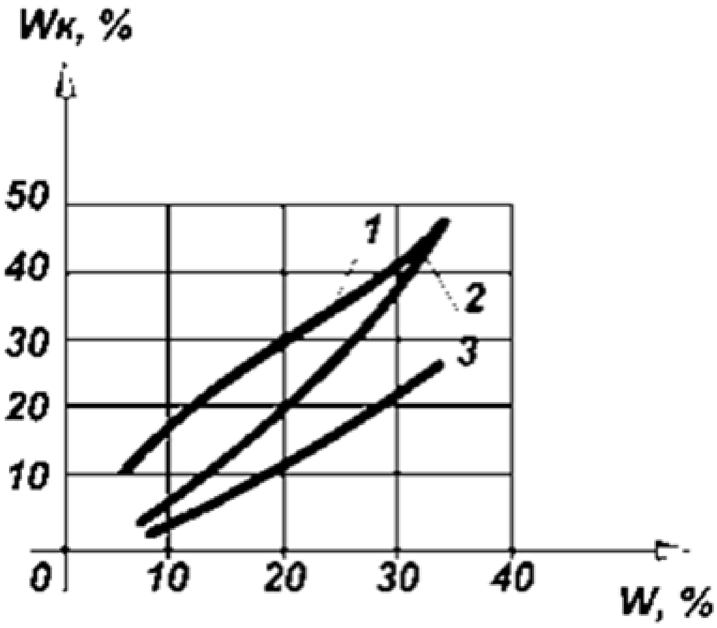

Fig.5. The relationship between the moisture content of cotton components and the moisture content of cotton: 1-bark, 2-seeds, 3-fiber.

Each indicator of the moisture content of seed cotton corresponds to certain moisture values of the fibers contained in it, the bark of the seed and magnesium. This situation is reflected in Fig.5.

As you can see from the graph, the fiber dries quickly when the cotton is exposed to hot air, while the seed dries relatively more slowly. Therefore, when drying cotton, the heating temperature of each of its components plays an important role. When drying cotton, the temperature of its fiber should not exceed 373-378 K (100-105 ^oC), with seed grain - 333 K (60 ^oC), with technical grain -358 K (80 ^oC).

If the temperature exceeds these values, then the mechanical properties of the fiber, as well as the germination and technological parameters of the seed decrease.

The relative velocity of the coolant has a great influence on the drying rate of cotton. Scientific studies show that the drying rate of seed cotton is highest at a coolant velocity = 1.00-1.45 m/sec.

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