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ANALYSIS OF THE IMPROVEMENT OF PNEUMATIC OUTLETS IN THE PNEUMATIC TRANSPORT SYSTEM

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Abstract: In this article, ways to reduce the level of damage during the transportation of cotton and its products in the pneumatic transport system in cotton processing technology are studied. Despite the fact that many scientific researches have been carried out to improve the components of the pneumatic transport system in the process of transporting cotton by pneumatic transport, researches on the pneumatic pipe and its hermeticity and the friction of the pipe with cotton have not been sufficiently studied in order to ensure the efficiency of the cotton raw material transportation in the air flow. Therefore, this article aims to research and prevent damage to cotton and its products in the pneumatic transport system.

Keywords: pneumatic transport, device, pneumatic pipe, turning part, transportation process, cotton processing, research, shock impact, quality indicators, polyethylene material, density, porosity, properties.

Introduction. Today, one of the main requirements for cotton ginning enterprises is to preserve the natural quality indicators of seed cotton raw materials undergoing all technological processes. Pre-treatment of cotton raw materials consists in maintaining the quality and natural properties of seed cotton and fiber products in technological processes and improving pneumatic transport devices [1].

The shape and size, porosity, density and plastic properties of cotton, volatility, coefficient of internal and external friction and other properties are taken into account when designing the technological process of preliminary processing of cotton raw materials and mechanization tools. These properties depend on the type of cotton raw material, which includes the above properties.

During processing in cotton ginning enterprises, cotton raw material is mechanically affected by the working surfaces of technological equipment, which has a negative effect on the quality of the produced product. Therefore, much attention is being paid to the research of cotton seed damage in the technological process chain, because seed damage is one of the main factors that significantly affects the quality of cotton fiber [2].

Methodology. The scheme of movement of raw cotton during processing is presented in Fig. 1. The speed of movement of cotton raw materials in pneumatic transport sections is 24...28 m/s. Seedling damage was detected in the processing of raw cotton with a moisture content of 9.4% and a contamination level of 1.3%, picked with a manual harvester of the 1st variety, the breeding variety Bukhoro-102. Samples for analysis were taken from 8 points marked with Roman numerals of the technological scheme as shown in Figure 1. Sampling and analysis were performed according to standard methods. The results of the study are presented in diagram form in Figure 2.

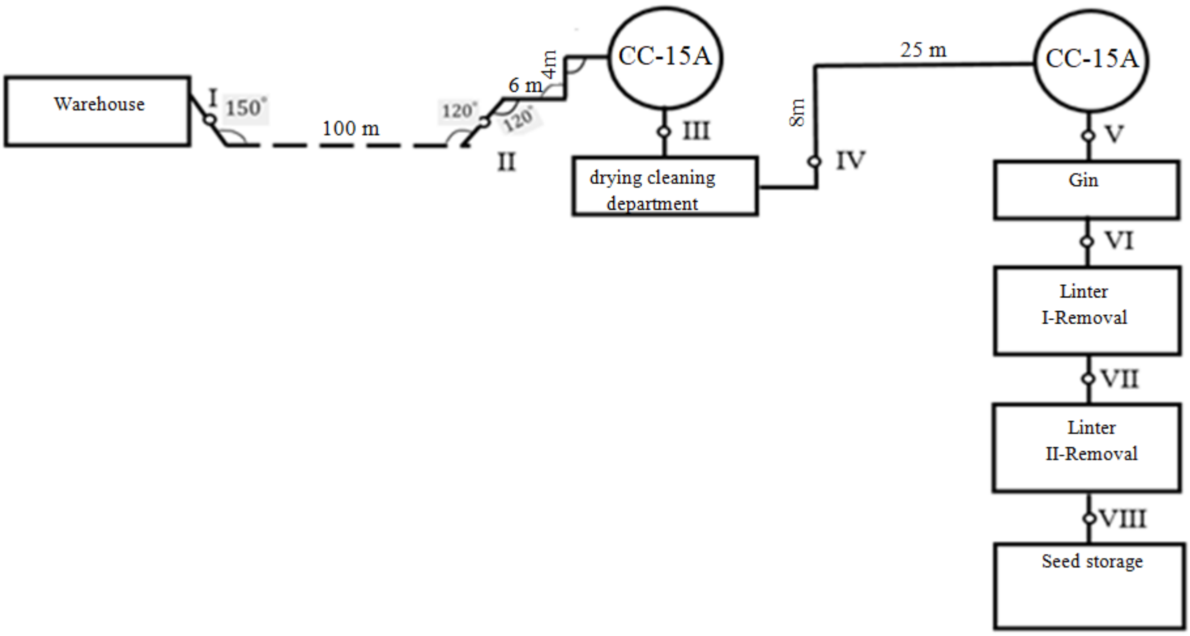
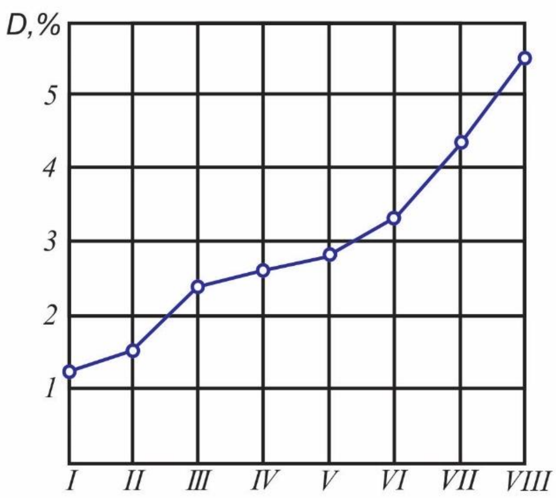


Figure 1. Scheme of movement of cotton raw materials during processing I - VIII - sampling points.



Sampling locations.

Figure 2. Diagram of changes in seed damage during the initial processing of raw cotton in a cotton gin.

With the increase in the speed of cotton raw material transportation in the pneumatic conveying device, damage to the seeds also increases, which causes a decrease in the quality of the cotton fiber, and a decrease in its germination when preparing the seeds for planting. Therefore, it is important to study the influence of the geometrical shape of pneumotransport elbows on the degree of damage to cotton seeds being transported.

However, until today there is no scientifically based method on this issue. According to our information, only Kha.A. Ziyaev [3] proposed to study the effect of the geometric parameters of the networks on the speed of pneumatic transport, that is, he proposed to change the angle of impact of the cotton raw materials on the working surfaces of the radial networks depending on the radius of the network rounding.

$$\upsilon_{м} = \frac{\upsilon_{кр}}{\cos \beta} \quad (1.1)$$

Here:

β - the angle between the direction of movement of the cotton raw material and the normal through the point of impact;

$\upsilon_{кр}$ - the critical speed for the cotton seed to hit the metal surface at an angle of 90°, resulting in increased seed damage;

$\upsilon_{м}$ - the speed of movement of raw cotton.

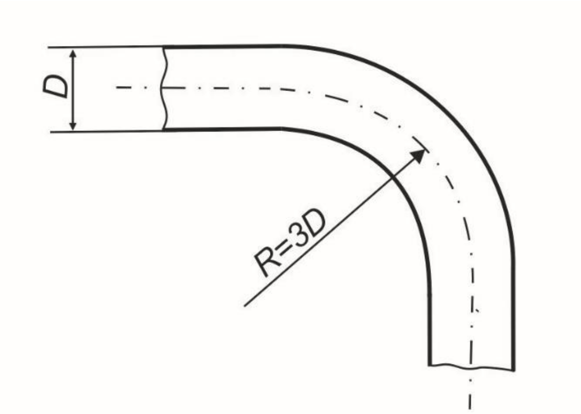


Figure 3. Elbow construction proposed by A. Ziyaev.

Researcher X. A. Ziyaev [3] found out that seed damage depends on the radius of the networks of the pneumatic transport device, and it was found that in pneumatic transport in a pipe with a radius equal to 3D, the rate of damage is equal to 3% when transporting cotton, and 10% when transporting seeds.

Based on the dependence of the radius of curvature of the pipe on the value of the angle of impact of the seed cotton on the outer wall of the pipe, it is recommended that the average radius of curvature in its bent parts is not less than 3D. In this case, a noticeable increase in the mechanical damage of seeds is observed up to the air flow speed of 28.4 m/s. A number of studies aimed at studying the effect of the formation of fiber defects and seed damage under the influence of pneumotransport were conducted in the "Cotton Cleaning IIchB" OA society.

Results. In this research work, since there is a lot of damage in the turning angles during the transportation of cotton in the pneumatic transport system, we proposed pneumatic pipe bends with geometrical shapes (radial, ellipse and parabola) and the movement of cotton in them was studied theoretically [4]. Among the offered elbows with different geometric shapes, a geometric shape that does not lose air pressure and does not affect cotton with excessive impact force was selected (Fig. 4).

Figure 4. Proposed parabolic elbow view.

A material selection has now been made to create an elbow that minimizes seed damage in the pneumatic transporter.

It is known that at present, pipes made of polyethylene products are widely used. These pipes do not rust (lasts for 50 years), do not require painting, do not interfere with the movement of the product (due to the smooth inner surface) and are better than steel pipes [5].

Delivery and installation of polyethylene pipes is also easy and cheap. Another advantage of polyethylene pipes is that they are resistant to cold (-70oC), retain their elastic properties, and are light in weight.

Polyethylene [-CH2-CH2-]n is a carbochain polymer of ethylene, an aliphatic unsaturated hydrocarbon. One of the simplest representatives of polyolefin compounds, polyethylene is obtained by polymerization of ethylene.

In order to polymerize ethylene, it is first converted into a liquid state in compressors under a pressure of 1200-1500 atm and poured into special reactors. Then, adding oxygen in the amount of 0.03% to diluted ethylene, the mixture is heated at a temperature of about 200°C. As a result, a part of ethylene is polymerized, and the rest is separated from the liquid polymer at a high temperature and sent back to the compressors for the polymerization process. During each cycle, 15-25% of ethylene is converted to polymer. In this method, unpolymerized ethylene is repeatedly sent to the reactor, and it is not allowed to be wasted [6].

Polyethylene obtained under high pressure, in addition to its strength, liquid temperature, specific gravity, especially dielectric properties and resistance to various aggressive environments and radiation, does not have a harmful effect on the human body, and in terms of other physicochemical properties, it is better than polyethylene obtained under low and medium pressure. completely different.

One of the main areas where polyethylene is used is the production of pipes of various diameters. Such polyethylene pipes are 6-8 times lighter than metal pipes, and their use in the transmission of water and absorbent liquids gives good results. Due to its resistance to the influence of polyethylene salt, acid and alkali solutions, pipes made of it are widely used in the manufacturing industry [7].

Table 1. Physico-chemical, mechanical and electrical properties of polyethylene in isotropic state.

Name	High pressure	Medium pressure	Lower pressure
Average molecular weight	300000	100000	700000
Relative weight g/cm³	0,96-0,97	0.92-0.93	0,94-0,96
Liquefaction temperature, °C	140-150	110-115	140-145
Glass transition temperature, °C	-60	-25	-60
Flash point, °C	-75	-65	-75
Heat resistance, according to Martens, °C	100	50	100
Tensile strength, kg/cm²	290-300	100-140	250-270
Relative elongation, %	1000	300-700	800
Residual elongation, %	800	200-500	600
Modulus of elasticity, kg/cm²	5000	2000	6000
Hardness, according to Rockwell, kg/cm²	20	13	16
Dielectric constant	2,2	2.3	2,4-2,5
Dielectric losses are the tangent of the angle	0,0005	0.0005	0,0005

Good mechanical and physico-chemical properties, ease of processing and cheapness made polyethylene to the first place among the synthetic polymers produced in the world.

This section focuses on the technology of making pipes from high-density polyethylene. Pipes can be obtained from other thermoplastics in the same way [8].

Discussion. Polyethylene pipes are mainly obtained by extrusion, that is, continuous squeezing through a hole of a certain diameter. The new improved polyethylene pipe elbow consists of adding erucamide to the polyethylene product to obtain a polyethylene pipe elbow that does not form a charge due to strong friction (Fig. 4). The technology of pipe production consists of the following steps: squeezing the softened mass of polymer in the form of granules through an annular hole in an extruder cylinder; calibration; cooling; consists of cutting into pieces of a certain length or rolling into drum-like drums.

The cross-section of the annular slot through which liquid polyethylene is squeezed out of the extruder should be slightly larger than the cross-section of the pipe. Because during calibration, the tube is partially stretched inside the nozzle. The polyethylene mass squeezed out of the head of the extruder enters the form of a cylinder and goes directly to the calibration nozzle. Here, the pipe cools down a bit, hardens and calibrates and begins to come out with a certain outer diameter [9].

Appearance of the substance Erukamide - granules of natural color. Density - 899 kg/m3; flow rate of solution - 20-25 g/10min; melting point - 110°C; Heat resistance - 290°C; Moisture - less than 0.3%; The recommended input is 0.2-4%, depending on the requirements of the manufactured products.

The pipe is usually calibrated on the outside diameter and the pipes are stretched in the transverse direction in two ways: by creating a vacuum or by sending compressed air through the pipe.

Since the pipe coming out of the calibration nozzle is thick and hot, it is flexible and easy to deform. Therefore, as soon as it comes out of the nozzle, it is cooled in cooling baths or by pouring water over it. Cooled pipes become rigid and non-deformable [10].

In the technological process of making pipes by the extrusion method, the length of the pipes is prepared in any size. To form long routes, pipes are connected by means of mutual welding, threaded fastening, fastening with special coating fasteners. Depending on the location of the cotton gins in the enterprise, the length of the tracks can be up to 200, 300, 500 meters.

For example, the polyethylene used to make the pipe should have a high molecular weight. It depends on the conditions of operation of the pipe (resistance to high pressure).

Pipe diameter d=20mm according to the technological scheme presented above. from, to d=500 mm, thickness 10 mm. to 30 mm pipes are produced. Screw extruders with a large diameter are used to obtain large-diameter pipes [11].

The experimental copy of the elbow prepared according to this research work was introduced into the production process of the Toragorgon cotton ginning enterprise belonging to "Namangan textile cluster" LLC (Fig. 5).

Figure 5. Introduction of the newly proposed elbow into the production process.

Experiments were conducted in the production process of the enterprise on the elbow of the proposed new design, the quality indicators of the products obtained from it were checked and compared with the actual indicators.

Conclusions/recommendations. As a result of the preparation of a new device for detecting seed damage in the pneumotransport system, it was possible to identify the points of the pipe with the most seed damage. It can be seen from the scientific research conducted in the pneumotransport system that the impact force on the steel surfaces exceeds the damage load on the seeds. Therefore, in this study, the turning parts of the pneumotube, that is, the shells, were replaced with a shell made of polyethylene material.

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