ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

Volume 10
Issue 1
2025

EFFECTIVE WAYS TO SEPARATE FIBERS SUITABLE FOR SPINNING FROM WASTE MATERIAL

MURADOV RUSTAM

Professor of Namangan Institute Textile Industry, Namangan, Uzbekistan
Tel: (0894) 272-9456

MIRZAAKBAROV AZIZBEK

Researcher of Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Tel: (0893) 490-9090
Corresponding author

Abstract: The high material and energy consumption of the analyzed fiber separation devices from fibrous waste and the uncertainty of fractionation reduce their efficiency, and the inability to separate fibers simultaneously makes it necessary to introduce additional technologies in some separation devices. This article studies the experiments and analyses conducted on the separation of short fibers included in the waste composition.

Keywords: grain, fiber, short fiber, sawn cylinder, staple length.

Introduction. In the world, great attention is paid to the development of techniques and technologies for cleaning fibrous materials as the main technological process of primary cotton processing. Therefore, it is of great importance to identify the processes and causes of product loss in the technology of primary cotton processing, to develop mathematical models for modernization and optimization that ensure the elimination of fiber discharge along with waste. At the same time, it is important to create new efficient and resource-saving designs of fiber regenerators, and to develop their parameters that allow increasing the amount of fiber produced.

Residual fiber content of a seed is the weight of individual fibers longer than 6 mm that are attached to the seed after the previously loosely coiled (unattached) individual fibers are manually separated from 200 cotton seeds.

This value is compared with the degrees of cleaning (under-cleaning or over-cleaning) and the accuracy of the fiber separation process. Under-cleaning of the seed, i.e., over-cleaning of the residual fiber, leads to the production of pure spinning fiber, which reduces the fiber yield from the seed cotton. Over-cleaning of the seed also reduces its staple length due to an increase in the amount of lint [3].

The total linting of the seed is the weight of the cotton seed after the removal of the fiber or short fibers and fine hairs from it, expressed as a percentage of the initial residue of the broken seed for analysis. The amount of fibers remaining in the seed is determined by burning a 30-gram sample of the seed14 with hydrochloric acid vapors in a drying oven at a temperature of 120-130 ° C for 30 minutes. The burned short fibers and fine hairs are lightly wiped in a clean gauze bag for 2-3 minutes and separated from the seed. Cotton consists of a mixture of short-fiber alpha cellulose, picrin, picric acid, moisture, fat, and glue. It is similar in chemical composition to cotton fiber and is a complete material for the production of cellulose.

Depending on the quality of cleaning the seeds before fiber separation, the growing conditions of the cotton, and the maturity of the seeds received for processing, short fiber contains various amounts of impurities. According to the state standard, short fiber industrial grades have the following quality indicators:

It is determined by maturity, staple length, contamination, ash content, seed weight, and moisture content.

Short fibers are divided into types, grades, and qualities based on these sizes.

Short fibers are divided into three types depending on the length of the staple.

Type I - staple length more than 20 mm;

Type II - staple length from 11 to 20 mm;

Type II - staple length less than 11 mm; obtained from seeds covered with no more than 11% fluff.

Type I and partly type II short fiber are mainly used in the cotton fluff industry. Type III short fiber is used in the chemical industry. The main requirement for the quality of the fluff used in this industry is its purity - very little contamination with external impurities and uniformity in length. In this case, type III short fiber is not allowed to contain fibers related to short fiber in length.

Depending on the industrial grade of the seeds and the maturity of the fiber, staple fiber is divided into four grades:

Grade I staple fiber obtained from grade I seeds;

Grade II and III staple fiber obtained from grade II and III seeds;

Grade III staple fiber obtained from grade IV seeds;

Each grade of grade I and II staple fiber is divided into two classes according to contamination: high and low.

For chemical processing, type III short fiber must have a maturity of at least 75 percent, impurities - up to 7 percent, ash content up to 2.1 percent, seed weight - up to 0.3 percent, and moisture content up to 9 percent.

The length of short fiber intended for chemical processing should not exceed 11 mm. The staple length of short fiber is determined by State Standard 3818-72. The maturity, contamination, moisture and weight of seeds in short fiber are determined based on the conditions of State Standard 3818-72.

Fine lint is short fiber fibers with a staple length of less than 11 mm that are removed from cotton seeds during the fiber separation process (after the first and second short fibers are removed by saw linters).

Although fine fluff is a valuable raw material for industry, it is cheaper than staple fiber. Fine fluff, like staple fiber, is mainly used in the production of cellulose16. Cellulose produced from fine fluff, like that produced from staple fiber, serves as a raw material for the production of cotton cellulose, which is used to make various valuable products and fabrics (artificial silk, film, etc.).

The first row of linters after the gin and the seed cleaner is called the first linter. The machines in this row remove the first short fiber from the seed. The machines installed in the second row are considered the second row of linters and are called the second short fiber machines. After the second short fiber is removed from the seed, the seeds are sent to the third short fiber line and are called the third short fiber line.

From cotton seeds, mainly long and partly short fibers are obtained in the first row. The short fibers obtained in the first row are distinguished by their high quality and meet the requirements of the State Standard (fiber length is up to 20 mm). If linters operate at high efficiency (short fibers per kg linter) and short fibers are obtained in large quantities (in percentage terms), it is rare to obtain 1 type of short fiber. Usually, if the residual hairiness of the seed is high after ginning 1 type of short fiber, if linters operate at high efficiency and a small amount of short fibers are obtained, 1 type of short fiber is produced [4]. The tests showed that in order to obtain a total short fiber content of 9-10 percent, depending on the type and performance of the machines, the output of each machine for the first and second short fiber extraction should be 1000-1500 kg of seeds/machine hour and for the third short fiber extraction 1200-1400 kg of seeds/hour. The output of linters in relation to the seed can be as follows: in the first extraction - 2 types of short fibers (staple length from 11 to 20 mm) in the second and third extraction - 3 types of short fibers (staple length less than 11 mm). The extraction of short fibers from the seed is one of the main indicators of the linting process. The amount of short fiber extraction can be determined by the following equation.

$$Cp = Ob - Op$$

Where: O_b is the total hairiness of the seed after ginning, O_p is the hairiness of the seed after short fiber removal, as a percentage of the seed weight.

The 5LP linter machine, which is currently used to extract short fibers from degined seeds, differs from other linters used previously in its 1.5-2.0 times higher productivity, the sturdiness of its parts, and the size of the working chamber.

From the board of the feeding machine, with the help of a receiving drum 1, the seeds fall evenly through a chute into the working (seed) chamber 3 of the linter machine. Under the influence of centrifugal force created by the slats of the drum and as a result of the air flow, small impurities are removed from the mesh and are sucked out through the screw using a pneumatic transport process.

The tumbler, under the action of a saw cylinder, forms a rotating grain roller in the working chamber. With the help of the saw teeth, short fibers are separated from the combs with the help of air and sent to the condenser with the help of special pipes. Dead and impurities are separated under the influence of centrifugal force, fall through the comb onto a belt conveyor and are sucked with the help of air and sent to the stack. The grain, the short fibers of which have been removed to the required hairiness, slides from the combs and falls through the comb onto a collecting spiral conveyor and is discharged to the grain storage area.

References

1. Axmedxodjayev X.T., Obidov A., Kabulov M. Yangi tola ajratish mashinasini loyihalash. FarPI Respublika ilmiy-texnik anjumani materiallari. I-qism. Farg'ona, 20 - 22 aprel 2016 y. – 175-177 b.

2. Muradov R., Karimov E., Obidov A., Maxkamov A., Ergashev J. Tola ajratish qurilmasi. O‘zR patenti, G‘AP 00868, 2013.

3. Umarov A.A. Tola sifatini yaxshilash maqsadida arrali jinni ta’minlash jaraènini takomillashtirish. PhD dissertatsiyasi, Namangan, 2018, 195 b.

4. Sarimsakov A.U. Tola ajratish jaraèni samaradorligini oshirish maqsadida arrali jin ishchi kamerasini takomillashtirish. PhD dissertatsiyasi, Namangan, 2019, 198 b.

5. Bo‘riyev R.A., Jumaniyazov K.J., Salimov A.M. Paxtaning sifatini aniqlash. «O‘zpaxtasanoateksport» xolding kompaniyasi «Paxtasanoat Ilmiy markazi» aksiyadorlik jamiyati. Toshkent-2016, 144 b

6. Mirzaakbarev, A., & Muradov, R. (2023, June). The ways to reduce fiber emissions from ginneries. In AIP Conference Proceedings (Vol. 2789, No. 1). AIP Publishing.

C O N T E N T S

TECHNICAL SCIENCES: COTTON, TEXTILE AND LIGHT INDUSTRY

TECHNICAL SCIENCES: AGRICULTURE AND FOOD TECHNOLOGIES

CHEMICAL SCIENCES

TECHNICAL SCIENCES: MECHANICS AND MECHANICAL ENGINEERING

ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION