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FIBER WASTE CLEANING

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Abstract
This article highlights that only OVM-type cleaners have been produced for cleaning fibrous waste, and there has been insufficient scientific research aimed at improving these cleaners.

Keywords: Fiber, cotton cultivation, lintering, raw materials, OVP.

Introduction

The Republic of Uzbekistan is a global leader in cotton production and export, making cotton a key element of the country's economy. Producing high-quality fiber that meets international standards presents an important challenge for experts and scientists in the cotton processing industry, who must focus on improving existing techniques and technologies. Fiber waste includes ginned fiber waste, waste from fiber cleaners, waste from seed cleaners before the first linter, cotton fluff from regenerators and condensers, and waste generated during the processing of first- and second-grade cotton raw materials. In its unrefined form, this type of waste is a mechanical mixture of immature and diseased seeds of varying hairiness, growth levels, small tangled and large free fibers, fiber defects from the drying process, large and small impurities, leaf particles, and other contaminants.
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Fiber waste includes ginned fiber waste, waste from fiber cleaners, waste from seed cleaners before the first linter, cotton fluff from regenerators and condensers, and waste generated during the processing of first- and second-grade cotton raw materials. In its unrefined form, this type of waste is a mechanical mixture of immature and diseased seeds of varying hairiness, growth levels, small tangled and large free fibers, fiber defects from the drying process, large and small impurities, leaf particles, and other contaminants.
Devices for the mechanical cleaning of fluffy and dead products are characterized by active impact on the material being cleaned. They feature rotating working components such as piles, hammers, knives, and teeth. During mechanical cleaning, cleaners are classified based on the movement of the cleaned product.
These cleaners are divided into longitudinal and cross-moving machines, depending on the direction of the fluff or dead material movement. Longitudinal movement devices mainly

include pile-auger cleaners, while transverse movement devices include saw, pile, and knife drums.

Until the 1960s, mechanical fiber product cleaners were produced based on designs initiated by cotton ginning enterprises, and they differed in appearance and specifications. Single-row, two-layer auger, and three-drum lint cleaners with piles were used. The overall cleaning efficiency of these cleaners ranged from approximately 17-26%, with fiber transfer to waste reaching 8-13% and 9-11%, respectively. The contamination of fluffy or dead material was reduced to 0.3-2.6% (absolute), while the amount of fluff lost in the waste ranged from 4% to 22%. Despite the increase in the number of cleaning drums, their cleaning efficiency did not exceed 14-19% [2].

The main reason why machines for cleaning dead, fluffy, and fibrous waste are not widely used in production is their lack of efficiency. First, most of these machines have low cleaning efficiency (15-20%), and those with higher efficiency are often inconvenient to use in production and difficult to maintain due to their complex design, which often leads to product loss [3]. Despite the development of several other cleaners by various organizations, currently, only OVM-A type cleaners are used in cotton cleaning plants within the "Cotton-Textile Clusters" association.

Rieter (Switzerland), Trützschler (Germany), and Marzoli (Italy) [4] offer equipment systems for processing fibrous waste and low-grade cotton. The cleaning efficiency of these systems is high because they utilize needle, saw-type, and aerodynamic cleaners. However, the cleaning effect across these systems is nearly identical. A common disadvantage is that absolute cleaning is not achieved in any case; some fibers are removed along with foreign impurities and become secondary waste. To achieve a higher cleaning efficiency, the parameters of the machines are often adjusted. In light of this, scientific research is underway to develop more effective fiber waste cleaning equipment [5].

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In its unrefined form, this type of waste is a mechanical mixture of immature and diseased seeds with varying degrees of hairiness, different growth levels, small tangled fibers, large free fibers, fiber defects from the drying process, large and small impurities, leaf particles, and other contaminants.

As a result of the theoretical and practical research conducted, the OVP direct current fiber cleaner was developed and introduced to the cotton industry. The structure of the cleaner consists mainly of a saw cylinder, columns installed beneath it, fiber intake and output throats, a regulating valve, a waste conveyor, and a waste chamber.

The cleaning efficiency of the cleaner averaged 20-25%. During fiber cleaning, the fiber content of the waste was 50% [1].

It should be noted that the lint removal and transportation process in cotton ginning plants is carried out pneumatically, making it difficult to regulate. When the aerodynamic conditions of the linter equipment change, the process that determines the cleaning

efficiency along the working arc is disrupted. As a result, foreign impurities do not have enough time to fully separate from the fluff and are transported to the fluff pipe. Additionally, any disruption of the aerodynamic conditions leads to an increased loss of fluff products with the waste.

Devices for the mechanical cleaning of fluffy and dead products are characterized by their active impact on the material being cleaned. They feature rotating working components such as piles, hammers, knives, and teeth. During mechanical cleaning, cleaners are classified based on the movement of the cleaned product. These cleaners are divided into longitudinal and cross-moving machines, depending on the direction of the fluff or dead material. Longitudinal movement devices mainly include pile-auger cleaners, while transverse movement devices include saw, pile, and knife drums.

Lint or carcass contamination was reduced by 0.3-2.6% (absolute), and 4-22% of lint was lost with the waste. Despite the increase in the number of cleaning drums, their cleaning efficiency did not exceed 14-19% [2].

The main reason machines for cleaning dead, fluffy, and fibrous waste are not widely used in production is their lack of efficiency. First, most of these machines have low cleaning efficiency (15-20%), and those with higher efficiency are often inconvenient to use in production and difficult to maintain due to their complex design, which often results in product loss [3]. Despite the development of various cleaners by several organizations, only OVM-A type cleaners are currently used in cotton ginning enterprises within the "Cotton-Textile Clusters" system.

Rieter (Switzerland), Trützschler (Germany), and companies such as Marzoli (Italy) [4] offer equipment systems for processing fibrous waste and low-grade cotton. These systems have high cleaning efficiency due to the use of needle, saw-type, and aerodynamic cleaners. The cleaning efficiency across these systems is nearly identical.

A common disadvantage of these systems is that absolute cleaning is never fully achieved. Some fibers are removed along with foreign impurities and become secondary waste. To improve cleaning performance, the parameters of the machines are often adjusted.

In light of this, scientific research is being conducted to develop more effective fiber waste cleaning equipment [5].

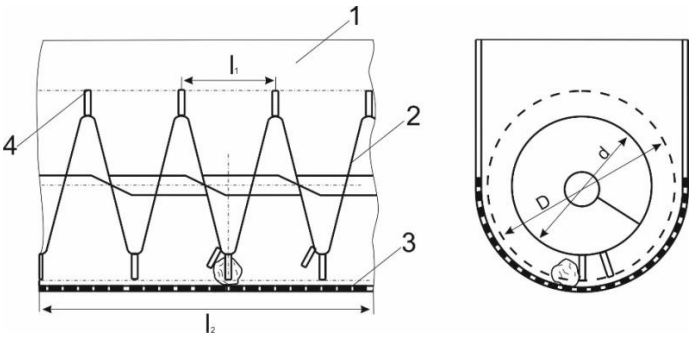

Figure 1. Schematic diagram of fiber waste treatment equipment
1 - Body, 2 - Screw auger, 3 - Net mesh, 4 - Stakes

To effectively separate mineral, organic, and other waste from fiber waste, the length of the recommended equipment can range from 8 to 16 meters. Based on scientific research, the pitch of the screw auger, the length and spacing of the piles, the optimal mesh net design, and the rotation speed of the auger working body are being carefully evaluated.

CONCLUSION:

A brief analytical analysis revealed that only OVM-type cleaners were produced for cleaning fibrous waste, and insufficient scientific research had been conducted to improve them. Although the technological process of equipment developed for cleaning fluff has been enhanced, it is evident that it cannot achieve the necessary quality standards due to the relatively short cleaning duration. These cleaners are only suitable for the fluff cleaning process.

After the cyclones in cotton ginning systems, a significant amount of fibrous waste is separated. The development of effective equipment for cleaning this waste remains one of today's urgent challenges.

The aim of the scientific research was to develop a cleaner design that provides effective cleaning of fiber waste, as a replacement for the OVM-type equipment.

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