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Analysis of Flours from Cotton Mills and Their Composition Elements

Abduraimova Nozima Jakhongir Qizi
Student, Tashkent Institute of Textile and Lyogkoy Promyshlennosti
st. Shokhjakhan, 5, 100000, Tashkent, Republic of Uzbekistan

Murodov Orif Jumayevich
Scientific manager, associate professor, Tashkent Institute of Textile and Lyogkoy Promyshlennosti
st. Shokhjakhan, 5, 100000, Tashkent, Republic of Uzbekistan

Saidova Nozima A'lovidinovna
Student, Bukhara Institute of Engineering and Technology, Bukhara, st. Q. Murtazaev 15

Abstract:

The article analyzes the separation of harmful compounds in the air stream coming out of various machines during the initial processing of cotton, to clean the dusty air that is released into the atmosphere, the air that is sucked from the dusting machines and the dusty air that comes out of pneumatic transport installations, and the ways of cleaning it from dust and impurities before releasing it into the atmosphere. The causes and ways to reduce the emission of large amounts of dust at all stages of the primary cotton processing process, reducing the pollution of dust production buildings and atmospheric air, worsening the working conditions of workers and employees, and causing them to suffer from occupational diseases, especially silicosis, are fully covered.

Keywords: seed cotton, dusty air, cyclone, dynamic analysis, dust particles, pneumotransport, conical cyclone, mineral fractions, air circulation speed.

Introduction. A large amount of dust is released at all stages of the initial processing of cotton, which pollutes the dust production buildings and atmospheric air, worsens the working conditions of workers and employees, and can cause them to get sick with occupational diseases, especially silicosis. The issue of dedusting cotton ginning enterprises is gaining primary importance in connection with the increase in contamination of machine-picked cotton. Today, with the increasingly widespread introduction of cotton picking in the cotton ginning industry, there is an urgent need not only to improve the technological process of receiving, storing and preparing cotton for processing, drying, cleaning and processing, but also to improve dust removal and atmospheric air purification systems. measures should be taken.

At the same time that great researches are being conducted in the world on keeping the environment ecologically clean, the dusty air coming out of the cotton ginning enterprises of our Republic is causing a certain amount of ecological damage. Today, we should pay serious attention to cleaning dusty air. In order to solve this problem, it is necessary to choose a cleaning technology for cleaning the dusty air entering the dust collectors, taking into account its composition, that is, first: to create an environmentally friendly cotton cleaning enterprise; secondly: it is one of the important tasks to carry out targeted scientific research in areas such as the development of technology for effective cleaning of residual dust by trapping fibrous waste going to waste [1].

A certain amount of dust is released from cotton during the initial processing of seed cotton in cotton mills. According to health regulations, the amount of dust in each cubic meter of air should not exceed 10 mg/m3, and the dust of the air emitted from factories should not exceed 150 mg/m3. To fulfill this condition in cotton ginning factories, it is required to clean the harmful dusty air coming out of each machine before releasing it into the atmosphere [2-7].

Cotton ginseng dust consists of organic and mineral fractions, and the organic fraction consists of ground particles of cotton bolls, leaves and bolls and ground fibers.

The mineral fraction consists of particles of soil, sand and other bodies that have been added to the cotton during harvesting.

At the beginning of the technological process scheme, i.e., during transportation and cleaning of seed cotton, mainly mineral dust is separated from it, and at the end of the technological process scheme, i.e. during ginning, lintering, fiber cleaning and pressing, mainly the organic fraction of dust is separated. 10...20% of the dust released in the pneumatic transport system is the organic fraction, and 80...90% is the mineral fraction, while at the end of the technological process scheme, that is, 80...90% of the dust coming out of the gin and linter condensers is the organic fraction [8-10].

The amount of dust in the air around the technological machines and in the production workshops depends on the type of seed cotton being processed, its humidity and dirtiness. Table 1 shows the amount of dust particles emitted by the air during the initial processing of seed cotton when the contamination of type III, picked by hand, is 1.3...3.5%. percentages of size and amount are given [11, 12, 13].

Size and percentage of dust particles

Table 1

The size µ	0-50	50-70	70-90	90-160	160-190	190-250	250-500	5800-1000	1000 and above
Dust particle size, %	3	12	9	5	4	11	12	9	3

Table 2 presents information on the amount of dust and air emitted from the main technological machines.

Air from the main technological machines and its amount

Table 2

Machines	Exhaust air	The amount of dust in the exhaust air
Air transport fan.	4,5 – 7	4000 . . .2000
Two gen condenser.	3,2	500 . . . 2000
four gin condenser.	6,4	500 . . . 1500
five linter condensers.	5,0	800 . . . 2000
six linter condenser.	6,0	800 . . . 2000
seven linter condensers.	7,0	800 . . . 2000
pneumatic seed cleaner. . ….. . . .	1,5	300 . . . 800

In cotton factories, the absorption of dust directly from the place of inhalation is called local absorption.

In cotton mills, local dust extraction is the main method, as dust is emitted from all the machines used for technological processes.

Table 3 shows the amount of dusty air sucked from technological machines.

Each vacuum cleaner is characterized by the dust holding capacity (%) determined by the following formula:

$$\eta = \frac{G_1}{G_2} \cdot 100. \quad (1)$$

where G_1 is the amount of dust in the released air; G2 is the amount of dust captured by the dust collector.

The dust holding capacity of each vacuum cleaner can be determined by the following formula:

$$\eta = \frac{d_1 - d_2}{d_1} \cdot 100. \quad (2)$$

where d_1 is the dustiness of the air entering the dust collector; d2 is the dustiness of the air coming out of the dust collector.

Amount of dusty air sucked from technological machines

Table 3

The name of the machines	Amount of air intake, m^3/s	Air dust, mg/m^3
Screw cleaner. . . . . ……………...	1,1	500...1000
Two drum-saw cleaner. . . . ……………………	0,88	15000...400000
Four drum-saw cleaner. . . . ……………………	1,80	150000...400000
Gin's four four drum purveyors. ………………	1,8	50000...150000
12-valve demon battery. . . . . . ………………...	2,7	100...500
5 linter battery. . . . . ………………	1,1	500...800
8-pin battery. . . . . ………………...	1,8	500...800
A waste-cleaning battery. . . …………………...	0,2-0,25	30000...200000
Fiber conveyor to the press box. . . . . ……...	0,6	100...300

In order to clean the dusty air released into the atmosphere, the air taken from the dust extraction machines and the dusty air from the pneumatic transport installations must be cleaned of dust and impurities before it is released into the atmosphere [14-24]. The dusty air is initially coarse, moderate and clean.

In coarse cleaning, particles larger than 100 μm (10-6) are separated from the dusty air, leaving more than 150 mg/m3 of dust in the cleaned air.

In average cleaning, dust particles with a size of 10 μm (10-6) and larger are separated, and the dust in the cleaned air does not exceed 150 mg/m^3. Such air can be released into the atmosphere.

Dust particles smaller than 10 µm (10-6) are captured during air purification, and the remaining particles in the purified air do not exceed 2...3 mg/m^3. Centrifugal dust collectors (cyclones) are often used to clean dusty air before releasing it into the atmosphere.

In cyclones, the air is cleaned of dust particles larger than 50 µm (10-6). When the air flow inside the cyclone turns in the form of an Archimedean spiral, centrifugal forces appear, and under the influence of these forces, dust particles hit the outer wall and fall to the bottom of the cyclone due to its reduced speed, that is, when the dust particles hit the inner core of the cyclone, they fall to the bottom of the cyclone, reducing their speed, and the purified air is reduced. it quickly rises up and exits the cyclone into the atmosphere. However, it should be noted here that these cyclones, invented at the end of the 19th century, are outdated today, and the development and analysis of a forecast for increasing the efficiency of newly modeled cyclones based on dynamic analysis of the movement of harmful compounds in the air flow during cotton cleaning is a very urgent problem. Cyclone separators (hereinafter "cyclones") were produced at the end of the 19th century and have become obsolete, but today they are the most popular cleaners and have very few analogues. In fact, cyclones in cotton gins were invented for extreme temperatures, pressures and loads of solid particles due to the advantages of high capital investment and maintenance-free operation, no moving parts, high reliability and high level of separation of existing solids from process gas streams. is an analogue, a copy [25].

A conventional cyclone mainly consists of a cylinder equipped with a tangential inlet, a dust chamber and a vertical outlet in a conical cleaning vessel, commonly known as a vortex finder. The dusty air flow in the process enters the cyclone tangentially with a very high angular velocity, so that the flow begins to rotate and changes its direction downward towards the top of the cone section. Therefore, the dust particles are collected in the dust collection chamber attached to the lower part of the cone section, and the dust-free air turns up and exits the cyclone through the vortex attractor (Fig. 1).

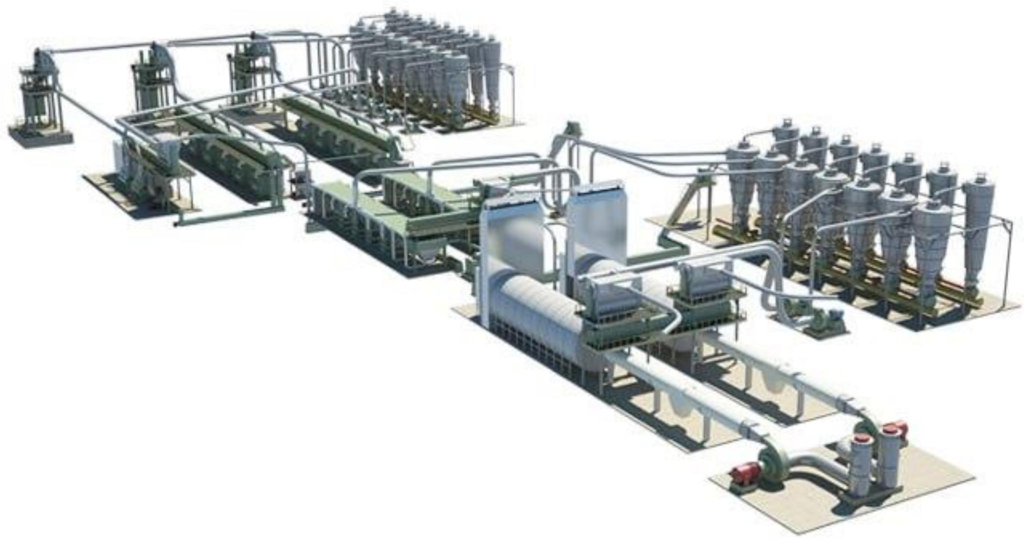

Figure 1. Cotton gin process flow

VZP dust collectors work as follows: Two unidirectional dusty air streams enter a mixer or separation zone located at the top of the suction pipe and primary filter. Particles caught under centrifugal force are separated (separated) on the wall and flow down from the hopper. It is discharged from there through a non-stop vacuum valve. As the downstream secondary flow spirals

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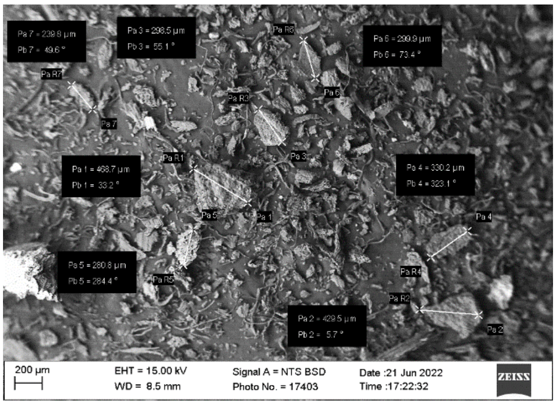
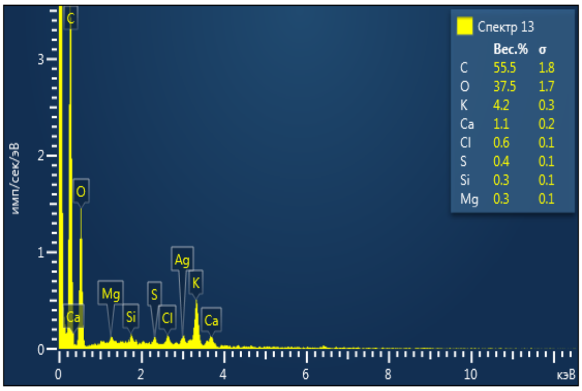
down the wall of the equipment, the return washer pulls it back up and joins the primary flow. Along with it, it leaves the suction pipe [26]. The composition and elements of dust particles emitted from cotton mills are shown in Fig. 2 (a and b).



a



b

α-spectral point; b- a plot of dependence of the spectral content of the particles in a unit of volume at the spectral point

Fig. 2 (a, b). Analysis of elements in the spectral points of dust particles

High humidity of the air in the system and the humidity of dust particles moving in it increases the probability of clogging of air cleaning devices and can lead to loss of reliability of its use.

According to the principle of operation of cyclones, as the velocity of the air entering it increases, the capacity of the cyclone to hold dust increases, and at the same time, the resistance of the cyclone also increases. The air circulation speed inside the cyclone is considered normal if it is 14...18 m/sec, and the dust holding capacity reaches 94...97% [27-29].

On the basis of the analytical analysis, it is necessary to pay great attention to the issue of separate separation of their constituents in the process of cleaning, with a deep study of the dust composition. In particular, the analysis of the dusty air cleaning technology available to date and the operation process of existing devices shows that no scientific and practical research has been conducted on the process of cleaning dusty air taking into account its fractional composition.

Summary. Based on these issues, it is necessary to indicate the following:

1. The impact on the cleaning process of dust particles transferred to currently used dust collectors and its composition have not been studied;

2. Theoretical and practical studies have not been conducted to determine the geometric dimensions of the dust particles coming to the dust collectors and their fractional composition;

3. Although the laws of movement of particles in the dusty air flow coming out of cotton ginning enterprises have been studied, the laws of movement of the dusty air flow as a multi-component mass have not been studied;

4. The process of cleaning the dusty air to a standard level and retaining the fibrous waste that goes to waste remains one of the main problems today.

Although the basic design of cyclones is very simple, their flow physics is very complex due to the three-dimensional nature of the flow, high level of turbulence, strong anisotropy and interaction between the liquid, dust particles and the surrounding wall and has not been fully understood even after several decades of research.

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