International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 4, Issue 1, January - 2025
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

Experimental Test Works of Water Cleaner for Dust Air Flow in Pipes Out of Cotton Factories

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Abstract

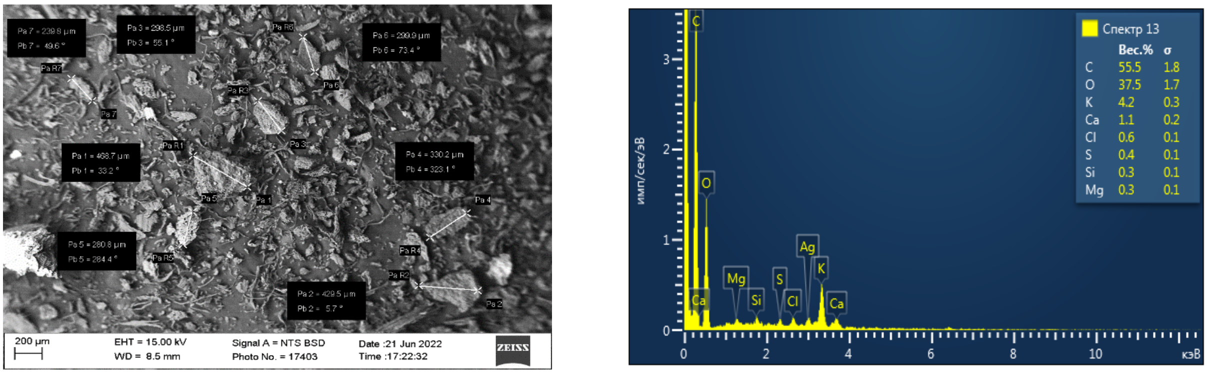
The article studies the composition, temperature and velocity of dusty air emitted from cotton ginning plants through practical research, and presents information on the design of a new improved unit with high cleaning efficiency and its advantages, using the temperature and velocity of dust, in accordance with the elements contained in the dust. Using the designed new design, it was experimentally tested in production and recommended for use in cotton factories.

Keywords: Dusty air, cyclone, dust particles, cotton gin, machine units, dusty air flow, aggregate, mineral and organic substances, minerals, atmosphere, environment, pipe, dusty air temperature, dusty air velocity.

Introduction

We know that in cotton factories all over the world, during the initial processing of cotton, dust rich in fibers and a number of other minerals is separated from it. Pipes with a diameter of 600 mm are used to transport the dust. The dust air flow is delivered to cyclone dust collector units through centrifugal air blowers. The dust in the pipe is dispersed and is constantly in chaotic motion, therefore, when cleaning dust with water, its composition, density, wettability, electrical charge of particles, resistance of particle layers, etc. are of great importance [1-3].

During practical research, we first determined the dust composition, velocity inside the pipe, and temperatures during the initial processing of cotton (Figures 1 and 2).



a b

a-spectral point; b- spectral point is the dependence of the spectral content of particles per unit volume

Figure 1 (a, b). Analysis of elements in the spectral points of dust particles

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It is worth noting that the cotton dust sample shown in Figure 1 was studied in the most modern laboratory in the republic, the only one in the country, at the "Advanced Technologies" Center under the Ministry of Innovative Development of the Republic of Uzbekistan, under contract No. A-3/173 dated June 17, 2022, and cotton dust was subjected to disperse analysis using a scanning microscope [4-10].

Image viewing and elemental analysis of cotton dust were performed using a scanning electron microscope (SEM EVO MA (10) Zeiss) with an X-ray detector (Oxford Instrument NanoAnalysys).

The table below shows the spectral data of the dust results determined by the scanning microscope according to Figure 1.

Table1

Element	Element type	Conditional concentration	Ratio. kg	Weight. %	Sigma weight. %	Benchmark name	Pre-installed havola	Target calibration date
C	K series	1.25	0.01253	55.45	1.83	C Vit	yes	
O	K series	0.77	0.00261	37.55	1.74	SiO_2	yes	
Mg	K series	0.01	0.00007	0.29	0.11	MgO	yes	
Si	K series	0.01	0.00010	0.32	0.10	SiO_2	yes	
S	K series	0.02	0.00015	0.43	0.11	FeS_2	yes	
Cl	K series	0.02	0.00022	0.63	0.13	NaCl	yes	
K	K series	0.17	0.00148	4.22	0.29	KBr	yes	
Ca	K series	0.04	0.00038	1.11	0.18	Wollastonite	yes	
Summa:				100.00				

The dusty air flow is sucked in by a centrifugal fan and delivered to the cyclone dust collectors through pipes. The velocities and temperatures inside the pipe are as follows: Figure 2. It should be noted that practical research was conducted in cotton ginning plants located in different regions of our republic, in different seasons. There are reasons for this, the use of water in dusty air cleaning has the effect of the outside air temperature, and the freezing of water in winter was taken into account and a solution was found for this. We will cover these solutions in our next scientific articles and theses [11-15].

a

b

a- temperature in the pipe *b- velocity and temperature in the pipe*

Figure 2 (a, b). Processes for measuring velocity and temperature in a pipe in winter

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As we can see, it is possible to use water efficiently to clean the dusty air flow in the pipe using its composition, speed and temperature, and it is implemented as follows: Figure 3. We have provided information about this project in our previously published scientific articles, and our new project is patented, and every researcher using it should not forget to cite it.

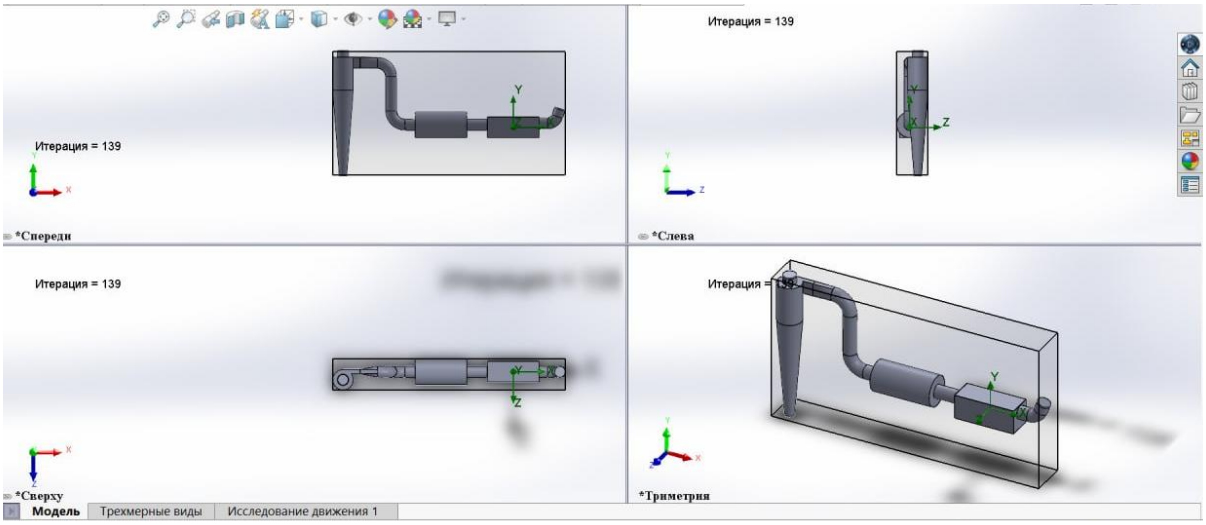
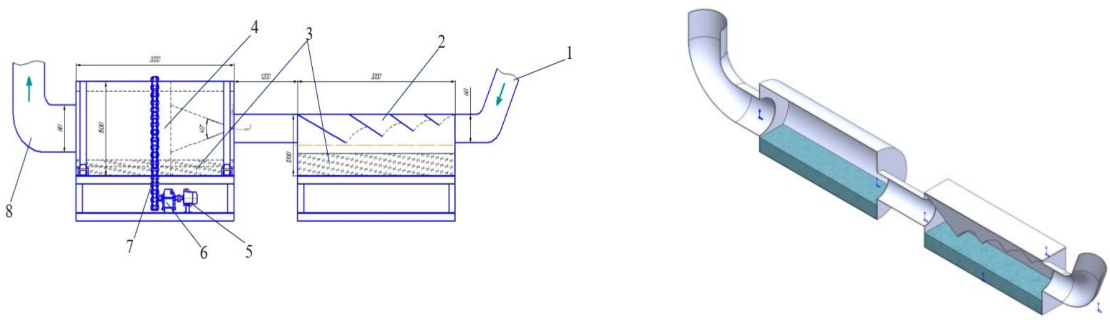


Figure 3. Model of a unit for cleaning dusty air flows from pipes coming out of cotton mills using water

This new model we designed consists of two water baths, all three of which have special dimensions, the first is a right quadrangular prism and the second is cylindrical, and the third is a cyclone with simulated parameters changed. We did not measure the temperature in the pipe in the winter season for nothing, because practical studies have shown that when the external air temperature is -70C, the temperature of the dust air flow inside the pipe is approximately 5.7≤t≤170C, as seen in Figure 2. This means that the project can work smoothly even in winter. The working principle is as follows, which can be understood in detail from Figure 3 (a and b).



a b

1-dust air inlet pipe; 2-dust air flow deflectors; 3-water; 4-rotating water drum; 5-engine; 6-reducer; 7-chain drive; 8-pipe for supplying partially cleaned dust air to the cyclone.

Figure 4. a- Structural diagram of the proposed dust air cleaning device in the pre-cyclone process b- 3D model in a cutaway view

As we know, physical and chemical processes are constantly taking place in the apparatus. In this construction shown in Figure 4, a physical process also takes place, and the dusty air hits the cones

2 through the 1st pipe and, changing its direction, continues its movement through the water surface inside the prism-shaped bath with a four-cornered base. Initially, the dusty air, which is partially cleaned in the prism-shaped bath, passes through the pipe to the drum, which is partially filled with water, at its own speed. The drum is rotated by the engine 5, and the inner walls of the drum are constantly wet. The dusty air coming through the pipe and partially cleaned is again cleaned by hitting the inner surfaces of the drum at its own speed and is delivered to an existing or simulated new cyclone [16-20].

Figure 5. General view of the recommended dust air cleaning device in the pre-cyclone process of cotton pre-processing

The advantage of this design is that using the speed and temperature of the hot dust air moving in the pipe, it is initially cleaned mainly with water through two water baths, the first of which is a prismatic one with a rectangular base and the second is a cylindrical drum, which in turn allows the dust air to be cleaned by 35-40 percent before the cyclone [21-38].

Conclusion

From the improved design, it can be seen that the sediments collected in the water are periodically cleaned and the water is replaced. The cheapest artisanal or river water can also be used in the baths. This improved new design can be installed on existing cyclone dust collectors for cleaning cotton lint, or it can be installed on cyclones with parametric changes developed by us. In this article, we have provided information about the advantages of cleaning the dusty air flow in the pipes coming out of cotton mills using water. We will cover the theoretical and practical results obtained from the operation of our improved model with a new design in our further scientific works.

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ISSN: 2980-4299
Volume 4, Issue 1, January - 2025
Website: https://scientifictrends.org/index.php/ijst
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