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Study of the discharge rate of dust from asbestos production facilities into the atmosphere

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Abstract. Now slate in Kazakhstan is produced at two modern plants in Semey (Semipalatinsk Plant of Asbestos - cement Products LLP-the largest of the two) and Shymkent (Tectum Engineering LLP). Currently, Kazakhstan consumes about 5 million sheets of slate per year, of which last year Kazakh enterprises produced 2.5 million with plans to increase production. Previously, all this volume was imported from abroad. The most loyal consumers are the southern regions, where, due to the hot climate, people remember and know how to handle slate, knowing its properties. For comparison, in Uzbekistan, about 35 million sheets of slate are consumed per year. The production of construction and technical products based on asbestos is accompanied by the formation of a significant amount of asbestos dust. At the same time, the main contribution to atmospheric air pollution is made by dust emissions with particle sizes up to 10 microns. In the industry's established practice, cyclones and bag filters are the most widely used for dedusting emissions. Experience of operation of these devices shows that due to the nature of the physico-chemical properties of asbestos dust required collection efficiency is not achieved (most of the fine fraction with particle sizes less than 5 μm cyclones virtually trapped; bag filters clogged fibrous asbestos dust), resulting in the concentration of dust in the air on the border of the sanitary protection zone of the enterprise is 7-10 times higher than the standard MPC.

1 Introduction

Methods of conducting the experiment are the selection of equipment for determining the sources of dust removal from the production sites of asbestos-cement materials, their size and physicochemical composition. To determine the amount of dust, we have adopted the currently existing Dust Analyzer unit "Atmas".

In the production of fiber astbest, dust removal from technological processes occurs at the site of the construction of wave slate and asbestos pipe structures, which are removed from the elevator, grinding Rotary (begunki), belt conveyors, cutting units and mixers. Small volumes of dust released from technological installations of the slate plant "Tectum Engineering" LLP in Shymkent are presented in Table 1. The volume of dust in the aspiration

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system was collected and measured on an electronic scale, and the amount of dust organized by production was determined using an Atmas Dust Analyzer [2] .

Table 1. Description of dust removal of technological installations of Shymkent slate plant "Tectum Engineering" LLP.

Name of the technological installation at the production site	**Performance of the Aspiration System, m³ / hour**	**Dust separation volume of technological equipment, kg / hour**	
		To the Aspiration System in production	**Unorganized magnitude**
Elevator	3610	1,82	0,15
Grinding spinner	3120	1,35	0,13
Ribbon carrier	5530	4.44	0,58
Asbestos dosing	10150	2,76	0,55
Slate cutting machine	740	0,33	0,12
Slate surface cleaning unit	2600	1,95	0,32

LLP "Tectum Engineering" the composition and volume of dust removed from the workshops in the production of Slate depends on the asbestos raw materials used in production. The analysis of the Aspiration System of technological equipment in the production of asbestos slate is presented in Table 2 below.

Table 2. Description of dust outlets in the Aspiration System.

	Aspiration System Performance, m³ / h	**Dust Volume, g / m³**	**dust diameter, mkm**
from asbestos blowing dosers	3000	0,6	30-60
asbestos grating sites	6000	0,6	5-120
from the dispenser, elevator foot, conveyor and runners	4000	0,85	20-25
from the dispenser, elevator foot and neck and runners	3000	0,75	20-25
from four dosers	6000	0,2	30-40
from the dispenser and media	6500	0,41	30-40
from carriers with a runner	3500	0,65	5-10

In comparison with the studies carried out, it turns out that the largest dust fibers in Slate production are formed in the places of asbestos grinding, and asbestos dust of the smallest thickness is formed in the runners.

The production of chrysotile asbestos in the Republic of Kazakhstan is carried out in Kostanay region, a large place in Zhetikara is JSC "Kostanay minerals". We determined the volumetric density of raw materials obtained from a large area of the slate plant "Tectum Engineering" LLP. We determine the samples taken in laboratory conditions, as shown in Section 2, the volumetric density of asbestos dust. As determined by laboratory conditions measuring instruments, the bulk density of asbestos fibers was 21.1 m2/g.

Dispersed analysis works-determination of the number of pollutant particles in groups (fractions) of the specified size per unit volume of the Dispersed Phase. Furthermore, the dispersed analysis with the size of the dust particles and the sitting speed study phases.

To study the basic properties of dust in production, which is made from asbestos materials, it is necessary to take samples of dispersed materils from the designated areas. For the determination of the dispersed composition, dust was obtained from aspiration systems that serve high-speed technological equipment. The volume of dust samples taken from the aspiration system required to pass through the tin was taken 100 gr. At the same time, the reduction of the sample was carried out by winding cones with a cross-sectional separator, and before conducting the study, the dust was mixed by the rolling method [3,4].

As mentioned above, for the comparative determination of the dispersed composition of dust in the production of Slate, samples were taken from two points from the Aspiration System, which provides technological equipment. The first point in the aspiration system is the way to enter the aspiration, and the second point is the way to exit the dust from the aspiration.

Based on the results of an electron microscopic study detected in laboratory conditions, natural chrysotile-asbestos revealed a fibrous structure characterized by a wide variety of morphological forms. The extensive location of zhetikara was determined in the laboratory at the slate plant "Tectum Engineering" LLP in natural conditions of chrysotile asbestos.

Chrysotile-asbestos fibers contained in chrysotile asbestos dust in natural conditions were obtained. To study the physical and chemical properties of chrysotile asbestos in laboratory conditions and obtain images of the surface of samples in the obtained natural conditions, a raster electron microscope tescan Vega\\ LSU (tescan manufacturing, Czech Republic) with an energy dispersion analyzer was used at the slate plant "Tectum Engineering" LLP, incapentafet-x3 (Oxford Instruments Manufacturing, England). The Tescan Vega \ \ LSU raster electron microscope (rem) fully allows you to study the properties and obtain electronic images of various samples placed in the microscope chamber for detection. The principle of operation of the raster electron microscope TESCAN Vega\\ LSU is based on the physical effects of the interaction of the surface of a solid sample with a directed electron beam. Raster electron microscopy, as well as radiospectral microanalysis methods, aim to irradiate the surface of the detected solid sample with a concentrated beam of high-energy electrons (up to 30 Kev).

Indicators of chrysotile asbestos of the zhetikara wide seat fiber roll is a natural type of hydrosilicates, which is easily broken down into crystalline and thin strong fibers. Figure 1 shows that in our laboratory conditions, according to research, two types of natural asbestos have been encountered, the first being "distributed fibers" and the second being "grouped fibers". Distributed fibers are distributed in an asbestos product from a single main fiber, and grouped fibers are wound together from several fibers.

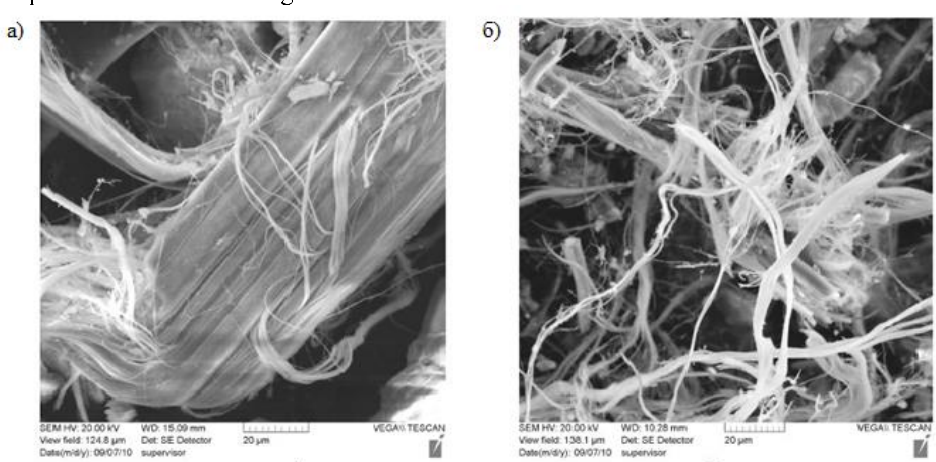

Fig. 1. View of asbestos fibers of the Zhetikara wide site in a natural pattern: a) in a branched Form, b) in a grouped form

To study the physical parameters of chrysotile fiber, we determined the quantitative indicators of the thickness and chemical composition of chrysotile asbestos fiber using the Inca Energy microanalysis system. Figure 2 quantitative measurement of chrysotile thickness and local chemical composition of asbestos fibers using the Inca Energy microanalysis system.

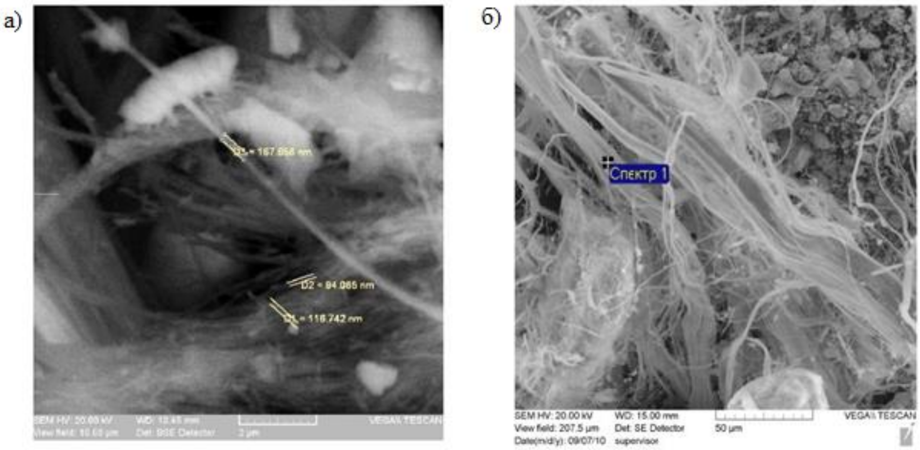

Fig. 2. Capture of the Inca Energy microanalysis plant of the zhetikara wide area: a) quantitative measurement of the chrysotile thickness of asbestos fibers, b) local chemical composition of asbestos fibers.

The results of the study obtained using Inca Energy microanalysis showed the presence of different values of the outer diameter of chrysotile fibers in the range from 94 to 167 nanometers, that is, it can be assumed that chrysotile asbestos fibers in the studied natural conditions belong to nanofibers. According to the analysis of scientific works, according to an international agreement, the concept of "fiber" refers to particles with a length of more than 5000 Nm, and the ratio of length (L) to diameter (D) L /d >3000 Nm [5].

At the same time, fibers with a diameter of less than 3000 nm are considered respiratory (respiratory particles-particles with an aerodynamic diameter of 0.5-5mkm, that is, they can enter the middle and lower respiratory tract). Fibers with a length of more than 8000 Nm and a thickness of more than 3000 nm are considered the most dangerous, because up to 5000 Nm fibers do not remain in the pulmonary alveoli and escape from the lungs.

According to the REM survey shown above, the results of measurements in the weight and atomic percentage ratio of 1 spectrum site on the surface of chrysotile-asbestos fibers in natural conditions show the composition of chemical elements in the table below.

Table 3. Chemical analysis indicators of the surface of chrysotile astest in natural conditions at the point of spectrum 1.

№	Item	Weight %	Atomic %
1	C	8,12	12,77
2	O	47,28	55,79
3	Mg	22,33	17,34
4	Al	0,48	0,33
5	Si	18,69	12,56
6	Cl	0,79	0,42
7	Mn	0,00	0,00
8	Fe	2,32	0,78
	Total:	100	100

As shown in the figure below, maps of distribution of chemical elements of chrysotile-asbestos fibers and distribution of the main elements of chrysotile-asbestos fibers were obtained using the Incapentafet-x3 energy dispersion spectrometer based on INCA Energy 350 software.

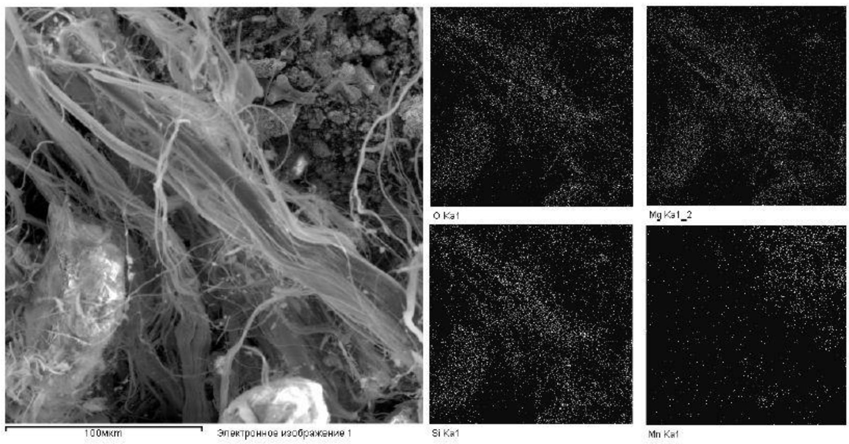

Fig. 3. Map of the distribution of elements on the surfaces of Natural chrysotile asbestos fibers.

As shown in the above mirotaps, each illuminated photon corresponds to a light point on the monitor screen. The focused electron beam synchronously scans the cathode ray tube, the density of the points on the screen shows the change in the concentration of the selected element in the scanning area O; Mg; Si; Mn, respectively.

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