WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 5, Issue 5, May - 2024

MODERN APPROACH TO THE HARMFULNESS OF COTTON DUST

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Abstract:
The article states that the dust emitted by textile industry technologies can cause an occupational disease called bisenosis, as a result of the exposure of cotton dust to the respiratory system of workers.

Keywords: Byssenoz, spinning shop, weaving production, cotton dust, aspiration system, MPC (maximum permissible concentrations).

Introduction

There are publications in the world press covering medical and biological problems associated with cotton dust and determined by the specific harmful effects of this dust on the human body.

Unlike other textile dusts, cotton dust can cause a respiratory disease called byssenosis (from the Greek word byssos - cotton). The cause of this disease remained unclear for a long time, but much pointed to the unique chemical composition of cotton dust, and it was its organic component that caused byssinosis. In recent years, information has emerged that the main causative agent of the disease is a crushed dust substance contained in the cotton plant and necessarily present in cotton at various stages of its processing.

It has been established that in the weaving industry, compared to the spinning industry, there is a significantly lower frequency of cases of byssinosis (0.6% compared to 13%) at the same air dust content of 0.2 mg/m3, determined using a vertical precipitator based on the content of particles in the dust of less than 15 μm. Presumably this is explained by the fact that the harmful substance that causes byssinosis is extracted during fiber processing or remains bound in the yarn, and therefore has a limited effect in weaving. In addition, the composition of dust in weaving production is characterized by a significant amount of sizing particles. Today, identifying the causative agent of byssinosis is an important medical and biological task.

Studies have been conducted in England that have established a close connection between the content of cotton dust particles in the air less than 4 microns in size and the incidence of byssinosis.

Cotton dust stands out from other dusts with a very wide range of geometric particle sizes: from 0.2 microns to 2 mm. These include both fibrous dust particles and other impurities contained in fibrous material and released from it during processing into the atmosphere of industrial premises or removed by aspiration systems. A quantitative analysis of the dispersed composition of cotton dust in the air of working areas in domestic cotton production shows a significant predominance of small dust particles less than 4 microns in size. The share of this fraction in terms of the number of particles is from 65 to 98%.

New assessments of the harmfulness of cotton dust have led to a critical revision of the maximum permissible concentrations (MAC) of cotton dust in a number of foreign countries, as well as to changes in traditional methods for determining air dust levels in cotton production.

The numerical value of the determined dust concentration in the air depends on the measurement technique. MAC levels adopted in different countries to varying degrees reflect the true dust content in the air, since different countries use their own measuring methods and instruments. For comparison, we provide information on the levels of maximum permissible concentrations of cotton dust and the measuring instruments used in some countries. The main features in measuring dust concentration are the different speeds of the suction air flow of the device when taking a sample, the division of the selected dust into fractions by some devices, and the method for estimating the mass of dust collected on the filter. Devices such as “Gravikon VTs25G” (Germany), “Hexlet” (Great Britain), “Aspirator model 822” (Russia), select dusty air at a speed of more than 0.2 m/s, ensuring the absorption of all dust particles suspended in the air, regardless of their sizes. If the device does not provide for the separation of dust into fractions, then dust content is measured for all types of dust (Germany, Switzerland).

In the Hexlet device, in front of the filter on which dust is collected, a mesh is installed to detect particles larger than 2 mm in size, mainly fibers. In a vertical precipitator (USA), due to low suction speeds and vertical movement of the air flow, particles smaller than 15 microns reach the filter. The separation functions of the vertical precipitator, determined by the maximum limit particle size of 15 μm, are determined, on the one hand, by medical and biological factors of particle deposition in the human lungs, and on the other, by the technical difficulties of separating dust particles into a smaller limit size. To realize fractionation of dust into a smaller size, it is necessary to reduce the speed of the suction air flow, which leads to a significant increase in the time of dust sampling. Reducing dust levels in the air requires improving existing and creating new technological equipment and processes that do not emit significant

amounts of dust, introducing additional stages of fine purification of air supplied for recirculation, expanding the air conditioning system, developing advanced devices for dust control and implementing other expensive technical solutions.

In the domestic textile industry, MPC levels for cotton dust, as well as other dusts of plant and animal origin, are established depending on the content of free silicon dioxide in the dust.

For all technological transitions of cotton production, with the exception of carbon monoxide departments and bag filter rooms, the content of silicon dioxide, as a rule, does not exceed 10% of the dust mass. Therefore, the maximum permissible concentration of dust in the air of the working area of the main workshops of cotton spinning production is taken equal to 4 mg/m3. As cotton is processed, the silicon dioxide content in the dust is reduced to 2% or less, and accordingly the MPC was taken to be 6 mg/m3. However, the hygienic harmfulness of dust in this case increases due to an increase in the amount of finely dispersed organic particles in cotton dust that can cause diseases in workers. Based on foreign experience, it seems advisable to conduct medical and biological research in order to tighten the standards for the permissible content of cotton dust, taking into account its dispersed composition.

The problem of SiO_2 content is also of great importance for the cotton ginning industry. The SiO_2 content is not the same throughout the transitions of the technological process of a cotton plant, therefore the maximum permissible concentration in the working area should be differentiated depending on its content. In the drying and cleaning shops of cotton factories, the maximum permissible concentration should be 2 mg/m^3, and in gin and press shops - 4 mg/m^3. From the above we can draw the following conclusions. In the world practice of hygienic regulation of harmful substances, there is a tendency to reduce the level of maximum permissible concentrations of cotton dust. Currently, there is a need to conduct special medical and biological research to clarify the harmful effects of cotton dust on the human body in order to adjust its maximum permissible concentrations, taking into account the dispersed composition of the dust.

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