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PURIFICATION OF ATMOSPHERIC AIR FROM DUST AND TOXIC GASES

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Annotation: This study examines the problems of cleaning atmospheric air from dust and toxic gases and ways to solve them. It is emphasized that atmospheric pollution is a global problem that negatively affects human health and ecosystems. The work analyzes existing technologies and methods of atmospheric air purification, including the use of dust collectors and gas cleaning devices at industrial enterprises, reducing harmful emissions from vehicles, phytoremediation methods (using air-purifying plants), and soil stabilization measures.
Keywords: atmosphere, dust, natural dust, artificial dust, organic and inorganic dust, gas, air, metal, cleaning chamber.
Аннотация: В данной работе рассматриваются проблемы очистки атмосферного воздуха от пыли и токсичных газов и пути их решения. Подчеркивается, что загрязнение атмосферы является глобальной проблемой, которая негативно влияет на здоровье человека и экосистемы. В работе анализируются существующие технологии и методы очистки атмосферного воздуха, в том числе применение пылеуловителей и газоочистных устройств на промышленных предприятиях, снижение вредных выбросов от автотранспорта, методы фиторемедиации (использование воздухоочистительных установок), мероприятия по стабилизации грунтов.
Ключевые слова: атмосфера, пыль, естественная пыль, искусственная пыль, органическая и неорганическая пыль, газ, воздух, металл, камера очистки.

The presence of particles of solid substances (metals, minerals, soil, wood, etc.) in the composition of atmospheric air or gas is called dust. The size of dust particles can be around 5-10 μm. The smaller they are, the easier they penetrate the body through the mucous membranes of the respiratory tract, nose, eyes, ears, oral cavity, and through skin ulcers, which can lead to various diseases. Dust is divided into 2 groups according to its nature and origin.

1. Natural dust. Dust generated by humans, plants, and animals, cosmic dust, volcanic eruptions, and earthquakes are not dependent on human activity. Therefore, they are called natural dust.
2. Artificial dust. Dust generated by human activity in industrial enterprises, construction, transport, energy, agriculture, and other sectors.

It should be especially noted that currently, compared to the pollution of the natural environment with natural dust, its pollution with artificial dust is accelerating. According to chemical and mineralogical composition, dust is divided into the following 5 main groups.

1. Organic dust. This group includes wood, cotton, cocoons, leather, paper, plastics, various plants, and dust generated during their processing.
2. Inorganic dust. This group includes soil, lime, marble, granite, cement, gypsum, ores, and dust generated during their processing.
3. Toxic dust. This group mainly includes dust that appears in chemical industry enterprises (for example, in nitrogen, phosphate, potassium fertilizers and paint production enterprises).
4. Explosive dust.
5. Combustible dust.

At the same time, it should be emphasized that the specific surface area (the ratio of surface area to mass, m2/kg) strongly influences the combustion and explosion of any body. Due to the small size of dust particles, their specific surface area is large. Therefore, they are flammable and explosive. For example, if a solid body with an area of 1 cm2 is divided into small cubes with a size of 0.1 μm, then the total lateral areas of these cubes can reach from 6 cm2 to 60 m2. Thus, the size, mass, and density of dust particles can strongly influence dust movement. According to Archimedes' law, if a particle's density is equal to or less than the density of air, it floats suspended in the air, and if it is greater, the dust settles on the ground. Since the density of heated air is less than the density of humid air, it is located in the upper layer of air.

Therefore, air conditioners are installed at the top of the room, and heating devices, on the contrary, at the bottom of the room. In the spinning mills of textile and light industry enterprises, an artificial steam environment is created using special air conditioners. The main purpose of this is to reduce thread breakage and to precipitate short fibers and dust separating from the threads as a result of continuous vibrations. It should be noted that aerosols also belong to the dust group. Dispersed systems smaller than 10 μm are called aerosols. In industrial enterprises, 1 lm3 of air can contain 100 mg or more of dust. Therefore, depending on the safety of dust, gases, and vapors, their maximum permissible concentrations (MPC) are determined at workplaces.

The maximum permissible concentration is understood as the amount of harmful substance in the air that does not cause harm to humans, flora and fauna, or the natural environment as a whole. If the amount of harmful substance in the air exceeds its permissible limit concentration, then the working hours at the enterprise are reduced, dairy products are provided to compensate for the damage caused, and additional payments are made to the salary (often the costs of treatment are paid). It is known that cement used in construction contains the element hexavalent chromium. Chromium compounds are also used for tanning leather. but in the amount of 0.001% of chromium compounds in air presence causes allergic disease. Therefore, the main goal of air purification is to equalize or reduce the amount of harmful substances to their permissible limit concentrations. Among dusty air purification devices, dust settling chambers occupy a special place. A periodically or semi-continuously operating cleaning device for cleaning dusty air from dust particles under the influence of gravity (P=mg) is called a dust settling chamber or dust bags. A stream of dusty air enters the chamber at a certain speed, and the dust particles, under the influence of their own gravity, fall into one of the dust collection chambers, and the purified air exits the cleaning device. It should be especially noted that dust settling chambers are designed to capture solid particles with a size of 100 μm and larger from the dust air composition, and they are used in the first stage during cleaning. Dust air purification The efficiency of the device depends on the speed of the dusty airflow. When the velocity of the dusty air flow in the cleaning chamber is 1 m/s, the degree of cleaning of dusty air is 60-80%, and when it reaches 3 m/s, the degree of cleaning does not exceed 40-50%.

Because when the speed increases, the dust particles settled in the cbang collector chamber begin to move again, mix with the purified air, that is, they create secondary pollution and exit the cleaning device. In such cases, the degree of purification drops sharply. Therefore, the speed of the dusty airflow should not exceed 3 m/s. To ensure the slow movement of the dusty airflow, the chamber volume is made larger. Therefore, although such cleaning devices have a simple structure, they occupy a large area. Multi-level dust settling chambers are used in industrial enterprises. The cavity in the chamber is divided into sections using inclined layers installed at certain angles. In the chamber, the dusty air flow moves slowly, dust particles hit the layers and settle under the influence of their own gravity. The settling time of dust particles in the layers is sharply reduced. To remove dust from the cleaning chamber, the layers are connected to a special shaking device. In barrier dust settling chambers (Figure 33), the dusty air flow hits the barriers, and dust particles fall into the dust collector chamber under the influence of gravity and inertia forces. This cleaning device also belongs to the group of coarse cleaning devices, in which the degree of cleaning of dusty air is 50-60%. In order to increase the efficiency of dust settling chambers (increase the degree of air purification), vertical barriers are installed inside them The dusty airflow, colliding with obstacles, reduces its velocity, and the dust particles, under the influence of inertia and gravity, fall into one of the dust collection chambers.

Reduction of pollination. This measure consists of dust capture, suppression of rising dust, and hardening of dust-lifting surfaces. Dust retention is carried out in drilling operations, crushing, sorting, agglomeration, and enrichment plants using mechanical, hydraulic, filter, and electric dust

collectors. The operation of mechanical dust collectors is based on the separation and settling of dust particles under the influence of their own weight, inertial force, and centrifugal force. The operation of hydraulic dust collectors is based on precipitating dust particles using liquid, i.e., "washing" dusty air. In filter dust collectors, dust particles are trapped in porous filter elements. The operation of electric dust collectors is based on the ionization of dust particles under the influence of electric current and their accumulation around the positive electrode.

Conclusion

Air pollution is a serious environmental and social problem. Dust and toxic gases harm human health, disrupt the stability of ecosystems, and cause economic damage. To solve this problem, it is necessary to take comprehensive measures in various spheres. The introduction of modern cleaning technologies at industrial enterprises, the reduction of harmful emissions from vehicles, the expansion of landscaping in cities, and the promotion of the use of renewable energy sources are of great importance. In addition, it is necessary to conduct constant monitoring of atmospheric air, improve environmental legislation, and form an ecological culture among the population. The combination of these measures contributes to the purification of atmospheric air and ensuring environmental stability.

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