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enter the atmosphere. Researchers estimate that the air environment of the underground mine's surface complex is
fılled with exhaust ventilatio part of transboundary environmental pollution. The mine wastes are also an environmental threat.

Ke ords: Air pollution, carbon-containing dust, environment, cardio-vascular diseases, respiratory tract diseases, human health, dust prevention and control, dust reduction

Introduction

Coal dust consists of ne coal powder, which is formed during drilling, blasting, crushing, screening, crumbling, taking into account its fragile nature, mechanical and owing transportation of coal and coal products. Air quality has the potential to be impacted by the coal dust emissions from coal mining activities, the transportation of coal from mines to designated ports and the loading operations at the port's export terminals.

Carbon-containing dust degrades air quality and ruthlessly distresses the natural bio-network and ecosystems and also has a serious impact on human health. Carbon-containing dust is a factor in increasing mortality from heart and respiratory diseases, decrease in pulmonary function in children and adults with the development of obstructive respiratory disease, and the increase in the frequency of symptoms. Health e ects are associated with both short-term and long-term impact of dust particles.

e environmental risk of carbon-containing dust emissions necessitates measures to dust o mine ventilation streams and reduce dust emissions into the atmosphere. To reduce the environmental hazard of coal mine dusts (carbon-containing dust), it is recommended that they are localized using dispersed water.

erefore, the disclosure of the peculiarities of the in uence of factors on the e ectiveness of the processes of interaction of dispersed

mathematical planning methods.

Discussion

When studying the dynamics of dust and dispersed water ows, we will consider dust particles and droplets of liquid as separate objects moving in the ventilation stream.

Let's choose the coordinate axes (Figure 1): x - is the longitudinal coordinate along the movement of the ventilation stream, starting from the place of creation of the dust stream (location of tne combine) or from the location of the water are, y - the transverse coordinate from bottom to top starting at the beginning near the production soil.

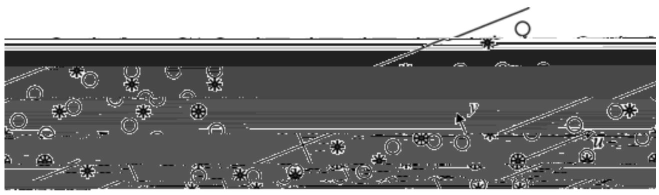

Figure 1: Scheme of motion and mechanical interaction of the sprayed liquid (circles) with carbon-containing dust (asterisks) in an incline working.

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$$m_i \frac{d\vec{U}}{d} = m_i \vec{g} - \vec{W} \qquad (1)$$

$\vec{U}$ – where mi - mass i – i-dust or liquid droplets, kg;

t – vector of relative velocity of a particle or droplet, m/s;

$\vec{g}$ – the time from the start of the ight of a particle or drop, p;

acceleration of gravity, m/s2;

$\vec{W}$ – force of resistance of movement of particles or drops, N.

In the projections on the axis of coordinates of the equation of motion of the particles of dust and liquid droplets are represented in the form

$$\frac{du}{dt} = -g\sin\alpha_1 - \frac{6}{\rho\pi d_i^3}W_x; \qquad \frac{d\upsilon}{dt} = -g\cos\alpha_1 - \frac{6}{\rho\pi d_i^3}W_y \qquad (2)$$

where u, υ – the projections of the velocity vector on the coordinate axis, m/s;

g- acceleration of gravity (assumed equal to 9,81m/s2);

α1 – working angle to the horizon, degrees;

ρ – the density of the particle or droplet (usually assumed equal to 1300 kg/m3 – for coal dust particles and equal 1000 kg/м3 – for wate);

d_i – diameter i – particles or drops, m;

W_x, W_y - projections of the vector of the force of motion resistance, N.

It is believed that the forces of resistance of movement of the body in the air are proportional to the kinetic energy of the relative motion and the area of the midsection of the body [3]. In vector form, this dependency can be represented as

$$\vec{W} = c_n \frac{\pi d_i^2}{4} \frac{\rho_0 |U| \vec{U}}{2} \qquad (3)$$

where c_n – a drag coe cient that depends on the velocity and diameter of the particles or droplets;

ρ0 – air density, kg/m3.

For relative motion in the air ow, the formula (3) in the projections on the coordinate axis, taking into account the sign of the direction of motion (on or against the ow) will take the form:

$$W_x = c_x \frac{\pi d_i^2}{4} \frac{\rho_0 |u \pm u_0|(u \pm u_0)}{2}; \qquad W_y = c_y \frac{\pi d_i^2}{4} \frac{\rho_0 |\upsilon| \upsilon}{2} \qquad (4)$$

where cx, cy – - projection of the drag coe cient on the coordinate axis;

u_0 ventilation ow velocity, m/s.

Substituting expression (4) into the system of equations (2), we obtain

$$\frac{du}{dt} = -g\sin\alpha - \frac{3\rho_0 c_x}{4\rho d_i}|u \pm u_0|(u \pm u_0); \qquad \frac{d\upsilon}{dt} = -g\cos\alpha - \frac{3\rho_0 c_x}{4\rho d_i}|\upsilon|\upsilon \qquad (5)$$

Add to the equations of system (5) the initial conditions on the assumption that particles or droplets at the site of their formation acquire at an angle of inclination to the ground of production a velocity that does not coincide with the velocity of air:

[illegible] (6)

where u_1 – initial velocity of dust particles or liquid droplets, m/s;

α2 – the angle of inclination of the initial velocity of movement of particles or droplets to the soil of production, degrees.

Numerous experimental studies [3] show that the coe cient of resistance of a spherical shape obeys the two-term law and can be assumed to be su ciently

$$c_n = 0{,}5 + \frac{24\nu}{|U|d_i} \qquad (7)$$

In Fig. 2 shows the calculated curve (7) and the experimental data [3] depending on the coe cient of resistance of motion of bodies of spherical shape from the local Reynolds number during the transition from laminar mode to turbulent.

e local Reynolds number [1] is meant to the ratio of the dynamic forces of a particle of dust or a drop of liquid to the forces of air viscosity

$$Re_x = \frac{|u - u_0| d_i}{\nu}; \quad Re_y = \frac{|\upsilon| d_i}{\nu} \qquad (8)$$

e maximum error of the calculated data, as shown by the comparison with the experimental data, does not exceed 10 - 20%. An analysis of the possible values of the local Reynolds number implies that it can vary widely. erefore, taking the minimum diameter d_{min} = 1 μm and the minimum velocity u_{min} = 0.1 m / s, we obtain Re = 0.007. And taking the maximum diameter d_{max} = 1000 μm and the maximum velocity u_{max} = 100 m/s [2], we get Re = 6667.

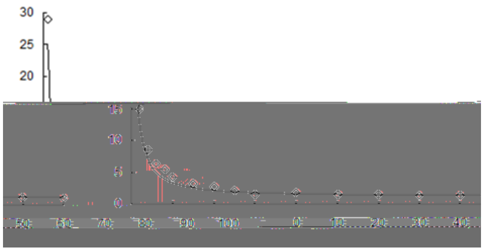

Figure 2: Dependence of the coeffcient of resistance of the motion of globular bodies on the local Reynolds number during the transition from laminar to turbulent mode

So, the movement of dust particles and liquid droplets will shi