RESEARCH OF CREATING PREPARATIONS FOR THE SUPPRESSION OF DUST ON QUARRIES HIGHWAYS

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Annotation. *Today, the Muruntau quarry, one of the largest in the world, and the roads around the quarry are more than 65 km long. That is why it is important to create drugs to suppress dust in the quarry and the roads around the quarry. As a result of the suppression of dust by the created drugs, the visibility on the roads increases, road traffic accidents decrease, the operation and repair time of heavy and expensive equipment increases, and as a result, the cost of them is significantly reduced. Most importantly, dust suppression creates fresh air and good working conditions for workers. To date, a lot of research has been done on dusting quarry and quarry roads [1-4].*

Keywords: *dust, quarry roads, starch, magnesium chloride, calcium chloride density, temperature, concentration.*

Over the years, scientists of the Navoi State Mining Institute and engineers and technicians of the Navoi Mining and Metallurgical Combine have developed and tested a number of drugs based on local raw materials to suppress dust in the quarry and surrounding roads. The production of convenient and inexpensive drugs for dust suppression will be launched by changing the composition of drugs, and there will be an opportunity to suppress dust on the roads of quarries. As a result, favorable conditions will be created for the work of technicians and workers in quarries and other sectors of the economy. In addition, as a result of increasing the operation and maintenance time of heavy and expensive equipment, foreign exchange costs are saved [5-7].

Water, mixtures, bitumens, salts, colloids, plant coatings and more can be used in dust suppression. Currently, the method of water suppression in quarries is widely used. The effectiveness of dust control depends on a number of indicators, the main of which is the ability of the dust to wet with water. Accordingly, the rocks are divided into hydrophilic and hydrophobic species. The following extreme angles were taken as an indicator of the wetting of the rocks by water: 0–10 ° for quartz, 46–47 ° for chalcopyrite, 55–60 ° for granite, 78 for sulfur°[8-9].

Well-wetted (hydrophilic) rocks include: quartz, sulfides, silicates, carbonates, and others. Some coals, graphites, sulfides, etc. poorly hydrated (hydrophobic) rocks. Various dusting additives are used to suppress hydrophobic dust [10].

The quarries use a variety of vehicles to transport rocks and minerals. Rail, conveyor transport and mainly road transport are widely used vehicles in quarries.

When vehicles move on quarry roads, they pollute the quarry air more than other vehicles. In the fight against quarry air pollution, water is sprayed on highways by special BELAZ trucks.

The water supply (efficiency) of a water spray washing machine pump is determined by the following expression:

$$Q_p = Q_{scw} \cdot B_{sw} \cdot V_{ss}\,, \qquad m^3/s,$$

herein Q_{scw} – specific consumption of water per unit of road surface once sprayed, m^3/m^2; B_{sw} – sprinkler width, m; Vss is the speed of the sprinkler, m/s.

The pressure of the machine pump is determined as follows:

$$Hp = H \pm Hp + \Sigma hi\,, \quad Pa,$$

herein Ҳ – the pressure of the water coming out of the tap, Pa; Hp – the pressure created by the vertical height between the pump axis and the tap mounting location, Pa; Σhi – the sum of the pressures lost in the pipelines, Pa.

The specific consumption of water in the suppression of dust depends on its evaporation rate, which can be determined by the following expression [8] (evaporation rate, in turn, depends on meteorological factors):

$$Q_{p.g.} = 5{,}3 \cdot 10^5 \left(1 + 1{,}55 \frac{T_n - T_{ю}}{V_{10}^2}\right)(L_n - L_2) \cdot V_{10} \cdot K_{ч}, \qquad kg/_{m^2 \cdot h}$$

herein $T_{ю}$ – road surface temperature, °C; T_n – air temperature at a height of 2 m above the road surface, °C; V_{10} – air flow velocity at a height of 10 m above the road surface, m/s; L_n – elasticity of saturated steam at road surface temperature, Pa; L_2 – the elasticity of the steam at a height of 2 m above the road surface, Pa; $K_{ч}$ – coefficient of calculation of additional water loss due to water entering and exiting the roadsides and passing cars [11-17].

An analysis of the scientific literature [9] and statistics shows that watering on quarry roads, especially when the air temperature is 40-50°C, requires watering at least 6-7 times a day. Or it dries up again before the water is sprinkled and the dust starts to rise. This requires the development and testing of dust suppressants.

According to the Decree of the President of the Republic of Uzbekistan dated April 6, 2017 No.PF-4891 "On critical analysis of the volume and composition of goods (works, services), deepening the localization of import-substituting production" requires that products be based on local raw materials [10]. Therefore, special attention was paid to the development of dust suppressants.

In this work, a drug based on modified technical starch and magnesium chloride from local raw materials was developed and tested at the Muruntau quarry.

It is important to study the rheological properties of technical starch solution compositions [18-20].

Viscosity and densities of technical starch and its compositions with magnesium chloride at different temperatures and concentrations were studied.

The viscosity of a technical starch solution with magnesium chloride was studied at different concentrations and temperatures using the Stokes method. The results obtained are presented in Table 1 below.

Table 1.

Viscosity of technical starch and its compositions with magnesium chloride at different temperatures and concentrations

№	The name of the composition	Composition- of concentrations mass. %	Temperature, °C / Viscosity, сПз			
			20^0C	30^0C	40^0C	50^0C
1	Starch + $MgCl_2$	4,0+1,0	0,211	0,209	0,198	0,196
2	Starch + $MgCl_2$	4,0+2,0	0,223	0,219	0,209	0,199
3	Starch + $MgCl_2$	4,0+3,0	0,229	0,224	0,217	0,203
4	Starch + $MgCl_2$	4,0+4,0	0,234	0,231	0,227	0,221
5	Starch + $MgCl_2$	4,0+5,0	0,251	0,248	0,244	0,239
6	Starch + $MgCl_2$	4,0+6,0	0,259	0,255	0,249	0,241
7	Starch + $MgCl_2$	5,0+1,0	0,246	0,242	0,237	0,233
8	Starch + $MgCl_2$	5,0+2,0	0,249	0,245	0,239	0,232
9	Starch + $MgCl_2$	5,0+3,0	0,253	0,251	0,246	0,239
10	Starch + $MgCl_2$	5,0+4,0	0,259	0,257	0,253	0,248
11	Starch + $MgCl_2$	5,0+5,0	0,267	0,265	0,260	0,258
12	Starch + $MgCl_2$	5,0+6,0	0,273	0,269	0,264	0,259

Analysis of the results of the analysis (Table 1) shows that as the concentration of starch increases, the viscosity of the composition also increases. The effect of temperature on the viscosity of the starch mixture was also studied (Table 1, Figure 1).

According to the study, the viscosity of the mixture decreased from 0.211 to 0.196 Pz as the temperature rose from 20°C to 50°C. This is explained by a decrease in the intermolecular forces between the molecules of the solute in solution.

The effect of magnesium chloride concentration on the powder suppressant was also studied. Analysis of the analysis results (Table 1) shows that the viscosity of the composition increases with increasing magnesium chloride concentration.

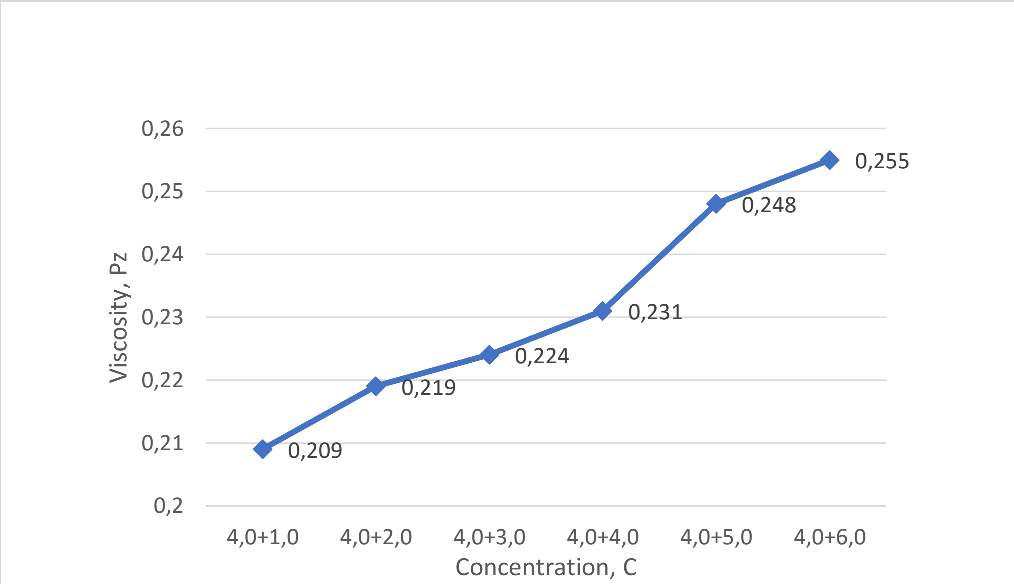
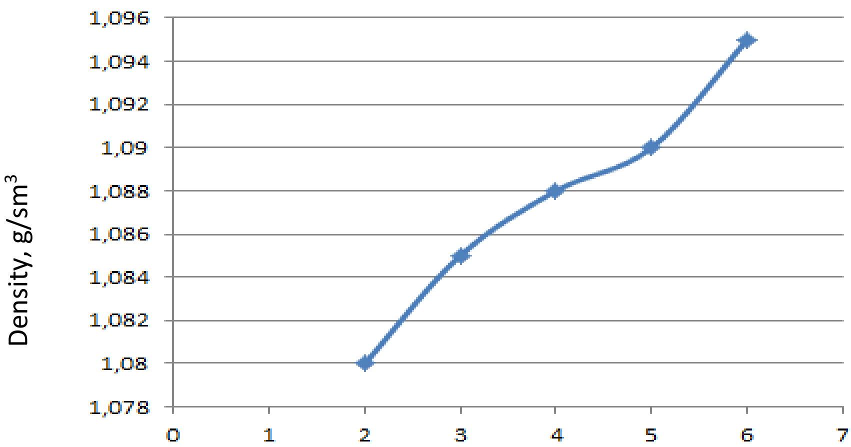


Fig.1. Dependence of the viscosity of the powder suppressant on the concentrations of starch and magnesium chloride

Hence, the viscosity of the powder suppressant depends on the concentrations of technical starch, magnesium chloride and the temperature of the solution.

The density of the dust suppressant was also studied. The results obtained are shown in Figure 2.



Content of magnium chloride, %

Fig.2. Dependence of the density of the powder suppressant on the concentrations of starch and calcium chloride

The results of the study showed that magnesium chloride increases the solubility of starch. This is because the dissolution of magnesium chloride in water is an exothermic process, so the water temperature rises around 40-50°C. As a result, an increase in the solubility of starch is observed. This is also explained by the formation of chelate compounds of magnesium chloride with starch macromolecules.

According to American research [11], about 10% of fatal diseases in cities are caused by air pollution. Huge air pollution is also caused by dust from mining and processing plants.

Large amounts of dust are caused by the formation of large "bare" areas in the surrounding terrai.

As a result, finely dispersed particles fall into the lower atmosphere. A significant increase in the maximum concentration of iron ore dust particles in the air poses a threat to human health, which in turn encourages the development of technological processes to stop the formation of dust.

The most commonly used process can be carried out with the use of these hygroscopic salts, which is the cheapest, most technologically advanced and has the least negative impact on the environment.

Thus, it was found that the use of an aqueous solution of technical starch at 6.0% by mass and magnesium chloride at 7.0% by mass as a dust suppressant was effective.

Analysis of the results obtained shows that the degree of dust suppression depends on the composition and amount of the drug, road conditions, spraying time, air temperature, wind speed and other factors.

This means that the composition solution based on technical starch and magnesium chloride can be successfully used to suppress dust in quarries and other highways.

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