METHODS FOR STABILIZING SHIFTING SANDS

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In article are considered some possibility of the syntheses and using, new polymeric composition material on base lignin in region Aral epidemic deathes. It is shown that problem drysands epidemic deathes is a global problem to contemporaneity. Polymeric preparations are received on base lignosulphonats with phosphor containing join. Called on field and experimental studies have shown that designed polymeric composition material and after three years of the field test did not lose their own applied characteristic. The of no small importance factor is and that technology and methods of the contributing composition material, does not require the complex technological operations and special preparation worker agrarian structure and farmer.

Key words: polymer, composite material, departure, erosion, syntheses, vegetation, lignosulphonat, water, saving, technology.

It is known that in intensive agriculture, the soil's organic matter ensures the soil's ability to absorb, accumulate, and evenly supply plants with water and nutrients applied with fertilizers, as well as maintain optimal soil water-air and sanitary regimes while preserving it as a crucial element of the biosphere [1]. Analysis of experimental data from numerous field experiments conducted in some European countries has shown that there is a close relationship between soil humus reserves and crop yields, primarily grain crops [2]. Numerous experiments simulating the humification processes of various herbaceous plants have shown that the lignin of plant residues remains unchanged for a long time, and only after a year does its decomposition begin very slowly. This process is more or less intensive, therefore, to form a stable clumpy structure, easily decomposing substances must regularly enter the soil.

For this purpose, we have developed new polymer compositions based on the phosphorylation of lignosulfonate using the Friedel-Crafts reaction. The lignosulfonate phosphorylation process was carried out under mild and accessible conditions. Lignosulfonate phosphorylation was carried out in the presence of Friedel-Crafts catalysts, according to the method described in the work [3]. 50 g of lignosulfonate powder, solvent dioxane (500 g), copper chips (several pieces) were placed in a four-necked flask equipped with a stirrer, thermometer, argon blowing capillary, and separating funnel. At a temperature of approximately 70°C, a phosphorylating agent - PCl_3 (5 ml) and a catalyst $AlCl_3$ (1g) were added slowly and intensely, in a 5:1 ratio, following the requirements of the method described in [4]. In this case, the calculation was made so that one or more lignosulfonate units undergo phosphorylation, as it is a high-molecular-weight compound. Then the solution was stirred for 4 hours at a temperature of 6.

The composition and structure of the "C-2" phosphorylated lignophosphonate were identified using modern physicochemical analysis methods.

In the IR spectra of the lignin phosphorylation product, there is a wide band of 3200-3400 cm-1, indicating the presence of OH groups included in the hydrogen bonds: 1710-1720 cm-1 C=0 bonds in the carbonyl and carboxyl groups 1620-1600 and 1530-1500 cm-1 - vibrations of the aromatic ring, as well as bands indicating the presence of simple ether bonds - 1120 and 1230 cm-1. Sand can be represented as a dispersed system in which the dispersed phase is the sand particles, and the dispersion medium, which surrounds each grain of sand, is water or air. Considering that sands must be treated with aqueous polymer solutions, structure formation will occur in the sand-water-binder system, the study of the electrical conductivity of sand dispersion in water is of interest. The study of the electrical conductivity of sand dispersion in various media revealed surface dissolution of its grains with the appearance of neoplasms forming a contact zone at the sand-bonding interface, and with an increase in the pH of the medium, solubility increases. We have presented data on the study of the acid-base properties of the sand surface, which is in contact with the atmosphere for a long time at 20°C and heated to 70°C. The indicated two states cover the different degree of surface hydration and characterize its properties in various technological processes.

It has been established that contact with the atmosphere at 20°C leads to complete hydration of the sand surface and shielding of its active centers with an adsorption layer. In this state, the surface has weakly acidic (pH=6.3) and weakly basic (pH=7.1) properties. Strongly acidic and strongly basic indicators do not ionize during adsorption on the hydrolyzed surface, therefore, in the spectra of indicators with a pH of 7.2 transition, only acidic bands are present, and with a pH of 6.3 - bands of the basic form. At 70°C, partial dehydration of the sand surface occurs, accompanied by an increase in weakly acidic centers with a pH of 3.2-1.7. Strong acidic centers with negative pH values remain shielded by residual water molecules.

Studies of the sand surface revealed the negative influence of water adsorbed by the quartz surface, which shields the strongly acidic and strongly basic centers and prevents their interaction with the binder. Monolithic protective coating must perform its functions for 1.8-2.5 years, provided that mechanical forces are excluded from it. Its durability depends entirely on the weather resistance of the binder. The binder-sand layer, in addition to atmospheric resistance, must also have the ability to pass atmospheric moisture through itself and retain sand moisture, which is especially important in arid and extrarid conditions. If the coating possesses a combination of these properties, then phytomelioration will have increased effectiveness. The kinetics of polymer-sand structure formation is related to the rate of sand-polymer interaction processes, particularly adsorption, which determines the adhesion properties. To clarify the nature of adhesion, it was necessary to study the nature of the corresponding formation.

The most important characteristic of the monolithic polymer-sand coating, which reveals its operational properties, is the value of its plastic strength at low loading speeds. As expected, as the sand's contact time with the binder increases, the coating strength increases after 16-18 hours according to an exponential law.

At the first stage of the research, as a result of the experimental work carried out in the field, the compositions and possible concentrations of the fixative were determined. The concentration of the composite polymer binder in the aqueous solution of the binder was 1.5%.

Protective crusts were obtained by impregnating layers of dry and wet sand with binding agents. At the same time, the binder consumption varied from 0.5 to 3 l/m2.

The resulting protective crusts, after measuring their thickness, were tested for wind resistance in an aerodynamic pipe, observing Frud's analogy. Then, the plastic strength and mass loss of the samples were determined (Table 1, 2).

Table 1 - Main parameters of the wind resistance of the protective layer made of a 2.2% composite stabilizer solution

Polymer consumption, l/m^2	On dry sand			On wet sand		
	Crust thickness h, mm	Plastic strength P, MPa	Mass loss of samples m, %	Crust thickness h, mm	Plastic strength P, MPa	Mass loss of samples m, %
3	5-9	5,5-4,4	0,7	15	5,7-4,9	0,3
2	5-7	5,2-3,8	3-5	10-13	5,5-4,2	0,5
1,5	3-5	4,2-3,6	15	8-11	4,7-4,2	1-3
1,0	3	3,8-3,2	20	5-6	3,9-3,4	3-5

As the experimental results showed, with the same binder flow rate, the protective crust on wet sand has a lower mass loss compared to the crust obtained on dry sand after blowing. At the same time, the crust thickness on wet sand wears out significantly less (2-7 times).

Protective crusts obtained on dry sand at a binder flow rate of at least 1.5 l/m2 proved to be more resistant to wind loads, while on wet sand, crust stability was observed at a lower flow rate of 0.5 l/m2. This is likely a consequence of the thickening of the crust on moist sand due to the impregnation of the binder to a greater depth and the formation of a 2 times thicker protective layer.

Table 2 - Main parameters of the wind resistance of the protective layer made of 1.5% "C-2" polymer sealant solution

Binding consumption q, l/m^2	On dry sand			On wet sand		
	Crust thickness h, mm	Plastic strength P, MPa	Mass loss of samples m, %	Crust thickness h, mm	Plastic strength P, MPa	28 / 1000 Mass loss of samples m, %
3	5-10	5,5-4,9	0,7	17-21	5,8-8,4	0,3
2	7-5	5,3-4,2	3-5	11-14	5,5-4,6	0,5
1,5	4-3	4,2-3,6	20	9-10	4,6-3,9	1-3
1,0	3-2	2,5	20	5-9	3,7-3,2	3-5

Considering that desert areas with shifting sands are classified as plains in terms of relief (plains are characterized by 5-10° terrain slopes), research was conducted to determine the required plastic strength value for such slopes. The plastic strength value of the crust at slopes 5-100 should be no less than 5 MPa.

Since a method combining biological and physicochemical methods was chosen for sand stabilization, special attention was paid to the fact that the effectiveness of phytomelioration increases with the creation of a protective binding sand layer with a complex of physico-mechanical properties necessary for long-term moisture retention under the crust. For this, it is necessary to create a reserve of moisture under the protective crust. It is clear that this can be achieved through natural and artificial methods, i.e., by sand stabilization after rain or after pr

In this case, sand samples from various regions of the Aral Sea region, treated with a binder solution of varying concentration, were tested. As a result of the research, it was established that the structural and mechanical properties of the system have the greatest resistance to external loads in the temperature range from 20°C to 80°C, samples treated with a binder containing the preparation "C-2" - 12%. In this case, the minimum value of the elastic-elastic characteristics corresponds to the maximum values of the true plastic viscosity.

The influence of various factors on the water resistance of the coating was studied, and the values of these factors were determined. Under the influence of various atmospheric factors and their combination, the structure of the protective coating undergoes profound qualitative changes, which are mainly determined by the change in the properties of the binder.

Change in the plastic strength of the protective coating formed in sand by impregnating the optimal concentration of the "C-2" preparation after testing the samples exposed in the IP-1-ZM and "Feitron" artificial weather unit, duration of 20, 40 and 60 cycles. The cycle consisted of 20 hours of ultraviolet irradiation at 30°C, 5 hours of sprinkling, and 3 hours of freezing at -15°C. The strength of the protective coating material reaches 5.28 MPa at the end of the first 20 exposure cycles, the further increase in the strength of the polymer-sand crust proceeds less intensively and reaches a maximum value by 40 cycles of testing, further a decrease in strength is observed. The tests showed that

After studying the aging process under the influence of a complex of factors, it was necessary to establish the role of each of them. Therefore, the change in plastic strength under the influence of heat, atmospheric oxygen, and ultraviolet radiation was studied. Data show that for the protective coating material, the most aggressive factor is the ambient temperature, which causes an increase in strength by almost 13 times during 300 hours of thermal exposure, while ultraviolet radiation increases Pt by only 7.2 times, and atmospheric oxygen by 12 times. With an increase in the saturation of the flow with solid particles, the carrying intensity increases.

Analysis of the obtained data on the study of coating properties shows that the developed coatings are not inferior in quality to existing coatings. Observations of the samples showed that when blowing with a wind-sand flow, primarily from the impacts of the flow's solid particles, protrusions and roughness are carried away, thereby creating a risk of e-foci.

Thus, the analysis of previously conducted research, as well as experimental work, shows that the preparation we developed based on lignin "C-2" is a potential organic resource when used as a melioration material to optimize the agrophysical and chemical properties of soils, primarily in the territories adjacent to the Aral Sea and the Aral Sea region.

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