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APPLICATION OF COMPOSITE MATERIALS ON THE BASIS OF WASTE FOR ANCHORING THE SANDS OF THE ARAL REGION

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ANNOTATION

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 dry Aral epidemic deathes is a global problem to contemporaneity. Polymeric preparations are received on baselignosulphonats 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.

KEY WORDS: ***Aral Sea, reagent, problem, salt, removal, polymer.***

INTRODUCTION

The problem of the drying up of the Aral Sea is a global problem of our time. This problem is aggravated by the fact that the moving sands of the dried bottom of the Aral Sea are highly saline, contain a huge amount of various harmful chemical reagents that are part of various mineral fertilizers and dust. One of the serious factors in the deterioration of the ecological situation in the Aral Sea region is the removal of salts and dust from the territory of these regions [1].

In this context, the problem of fixing the saline sands of the dried bottom of the Aral Sea, the creation of strong surface structures that do not interfere with plant growth and protect against weathering due to strong aerodynamic flow, is the most urgent problem of modern polymer chemistry and ecology in general [2].

It is known that the dried bottom of the Aral Sea is covered with a layer of saline moving sands with an area of more than 5500 thousand hectares. The content in them of water-resistant macrostructures greater than 0.25 mm, which are important for the cultivation of salt-resistant plants on these sands, is insignificant and often does not exceed 5-7% of the total mass of sand, as a result of which their rational use in the agricultural sector of the economy is difficult. In this connection, the problem of fixing sands from wind erosion through the creation of a strong surface crust is important, which ensures the fixation of mineral particles and salts in the places of their formation in order to prevent deflation [3].

In this aspect, the purpose of our recent research work is to protect moving sands from wind erosion by chemical fixing with the help of high-molecular composite additives obtained on the basis of industrial waste from chemical enterprises of our republic.

OBJECTS AND METHODS OF RESEARCH

Sand from the dried bottom of the Aral Sea, hydrolytic lignin, which was processed into a modified preparation "AMU-2" and Gipan, were taken as the initial raw material. Light gray sand, density - 2.67 g/cm3, bulk density - 1.42 g/cm3, specific surface area -760 cm2/g, porosity -44.0%, filtration coefficient - 4.2 m/day. The study of the sands of the Muynak deposit showed the following results: density - 2.55 g/cm3, bulk density - 1.40 g/cm3, specific surface 790 cm2/g, porosity 46.5%, filtration coefficient - 4.8 m/day. The presence in the sands of pores of various radii and discrete in distribution has been established.

Hydrolytic lignin is a waste product from the processing of sawdust and vegetable waste from agriculture in the process of hydrolysis production. Hydrolysis lignin is a polydisperse product with a particle size of up to 1 cm.

Technical hydrolysis lignin contains 64-78%, polysaccharide residues 20%, monosaccharides - 2.5%, mineral and organic acids - 1.5%, ash substances 4.5%. It is hygroscopic and has a moisture content of up to 65%. As a plasticizer and an additive that increases the water resistance of the coating after analyzing the properties of the binder, Gipan was chosen, which is a viscous white product. This product is produced by Navoiazot JSC.

In accordance with the tasks set in the work, a complex of modern research methods was used. These include a group of methods that make it possible to investigate: the physicochemical and chemical properties of sands, the processes of formation of structures in aqueous dispersions, binder; electrochemical properties of the sand surface in the process of interaction with binders; change in the strength of contacts between sand particles in a structural system.

The presence of various functional groups in the chains of binder molecules was revealed by IR, NMR and UV spectroscopy. The studies were carried out both on liquid and solid samples. The thickness of the liquid samples ranged from a few millimeters to 0.02 mm. Feitron".

The wind erosion resistance of crusts and coatings was determined by blowing them with air in a wind tunnel. For the mathematical description of the considered process of formation of the structure of the developed material, the results of experiments carried out by the Matlab method were used.

RESULTS AND ITS DISCUSSION

An analysis of articles and patents on the use of lignin, performed in Japan, reviewed in the journal Chemical Abstracts, showed the constant interest of researchers in the problem of using lignin in agriculture [4]. This issue was devoted to 6% (total 600 publications), and for a later period - 7.8% (total 190 publications) of the total number of publications on the use of lignin [5].

Lignin and products derived from it are proposed to be used as fertilizers, plant growth stimulants, insecticides, herbicides, agents that improve soil structure, additives to the diet of animals. Materials on the use of lignin in agriculture are also reflected in a number of review articles and monographs [6].

In intensive agriculture, soil organic matter ensures the ability of the soil to absorb, accumulate, and evenly supply plants with water and nutrients introduced with fertilizers, as well as maintain optimal water-air and sanitary conditions of the soil, preserving it as the most important element of the biosphere [7].

Long-term field experiments on soddy-podzolic soils in England, Russia, Germany, Belarus and other countries have convincingly shown that with the optimal dose of mineral fertilizers and advanced agricultural technology, it is impossible to increase the reserves of organic matter only at the expense of crop residues [8]. Analysis of experimental data from numerous field experiments carried out in some European countries have shown that there is a close relationship between the reserves of humus in soils and the yield of agricultural crops, primarily cereals [9].

Thus, the introduction of 8-10 tons of organic fertilizers per 1 ha annually stops the loss of humus. In addition, there are vast tracts of land to be developed. These are unproductive upland meadows and pastures overgrown with shrubs, forest clearings, burnt areas, etc., which need organic fertilizers. The use of lignin as organic fertilizers, with additives necessary for these soils (nitrogen, calcium), can give a positive effect with a long aftereffect, since lignin humification occurs much more slowly than conventional organic fertilizers.

Attempts to use lignin as an organic additive in agriculture have been made for a long time. Japanese researchers studying the decomposition of sulfite liquor in the soil found that the purified lignosulfonate is quite resistant to decomposition. In numerous experiments simulating the processes of humification of various herbaceous vegetation, it has been shown that the lignin of plant residues remains unchanged for a long time, and only after a year does its decomposition begin very slowly.

The study of the process of transformation of lignin in soils allows you to develop ways to use lignin as a fertilizer. It has now been established that all components of plant (and animal) tissue, as resistant to microbial action, take part in the formation of humic substances. Linearly constructed associates were found in undecomposed plant remains, however, the substances formed during the microbiological decomposition of the remains are of greater importance. This process is more or less intensive, therefore, for the formation of a stable lumpy structure, easily decomposing substances must be regularly supplied to the soil. In this context, it was of interest to study the properties of sands from the dried bottom of the Aral Sea and to develop optimal compositions and study their properties.

For this purpose, we have developed new polymer compositions based on phosphorylation of lignin by the Friedel-Crafts reaction. The lignin phosphorylation process was carried out under mild and accessible conditions. The product of the reaction of lignin phosphorylation, which we called the drug "AMU-2", is a brown viscous product, odorless, stable during long-term storage. The composition and structures of phosphorylated lignophosphonate "AMU-2" were identified by modern physicochemical methods of analysis.

The IR spectra of the product of lignin phosphorylation have a wide band at 3200-3400 cm-1, indicating the presence of OH groups included in hydrogen bonds: 1710-1720 cm-1 C=0 bonds in carbonyl and carboxyl groups 1620-1600 and 1530-1500 cm-1 - vibrations of the aromatic ring, as well as bands indicating the presence of ether bonds - 1120 and 1230 cm-1. Sand can be represented as a dispersed system in which the dispersed phase is sand particles, and the dispersion medium surrounding each grain of sand is water or air. Given that sands must be treated with aqueous solutions of polymers, structure formation will occur in the sand-water-binder system, it is of interest to study the electrical conductivity of a sand dispersion in water.

The study of the electrical conductivity of the sand dispersion in various media revealed the surface dissolution of its grains with the appearance of neoplasms that form a contact zone at the sand-binder interface, and with an increase in the pH of the medium, the solubility increases. We present data from studies of the acid-base properties of the surface of sand that has been in contact with the atmosphere for a long time at 20°C and heated to 70°C.

These two states cover different degrees 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 screening of its active centers by an adsorption layer. In this state, the surface has slightly acidic (pH=6.3) and weakly

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basic (pH=7.1) properties. Strongly acidic and strongly basic indicators are not ionized when adsorbed on a hydrolyzed surface; therefore, the spectra of indicators with a pH transition of 7.2 contain only acidic bands, and with pH 6.3 - bands of the basic form.

At 70°C, partial dehydration of the sand surface occurs, accompanied by an increase in weakly acid centers with pH = 3.2-1.7. Strongly acid sites with negative pH values remain shielded by residual water molecules. Investigation of the surface of sands made it possible to reveal the negative effect of water adsorbed by the quartz surface, which shields strongly acidic and strongly basic centers and prevents their interaction with the binder.

A monolithic protective coating should perform its functions up to 1.8-2.5 years, provided that mechanical influences are excluded from it. Its durability depends entirely on the weather resistance of the binder. Astringent sandy layer, in addition to weather resistance, must have the ability to pass atmospheric moisture through itself and retain sand moisture, which is very important especially in arid and extra-arid conditions. If the coating has a combination of these properties, then phytomelioration will have increased efficiency.

The kinetics of the formation of a polymer-sand structure is associated with the rate of interaction between sand and polymer, in particular, with adsorption, which determines the adhesive properties. To elucidate the nature of adhesion, it was necessary to study the nature of the formation of the corresponding structures in the contact zone. The most important characteristic of a monolithic polymer sand coating, which reveals its operational properties, is the value of plastic strength Pt at low loading rates. As expected, as the contact time of the sand with the binder increases, the strength of the coating increases after 16-18 hours according to an exponential law:

$$P_T=A(I\text{-}/c) \quad (1)$$

- where A is the shear strength of the dried sandy substrate of undisturbed structure; I- time of contact, binder with sand.
Taking the logarithm of expression (1), we obtain the dependence of the increase in Pt on the change in the exponent in the limit of 0-18 hours, which is described by the following expression:

$$18\ I\ \text{-}P_T= [(IA + c)$$

Curves of changes in the strength of the coating depending on the hardening temperature (Fig. 1) show that the most acceptable results are achieved at a temperature of 40°C. A further increase in the hardening temperature leads to a strong increase in P, an increase in the brittleness of the material, apparently, this is due to a sharp removal of the dispersed medium, which in turn prevents the processes of structure formation in the contact zone.

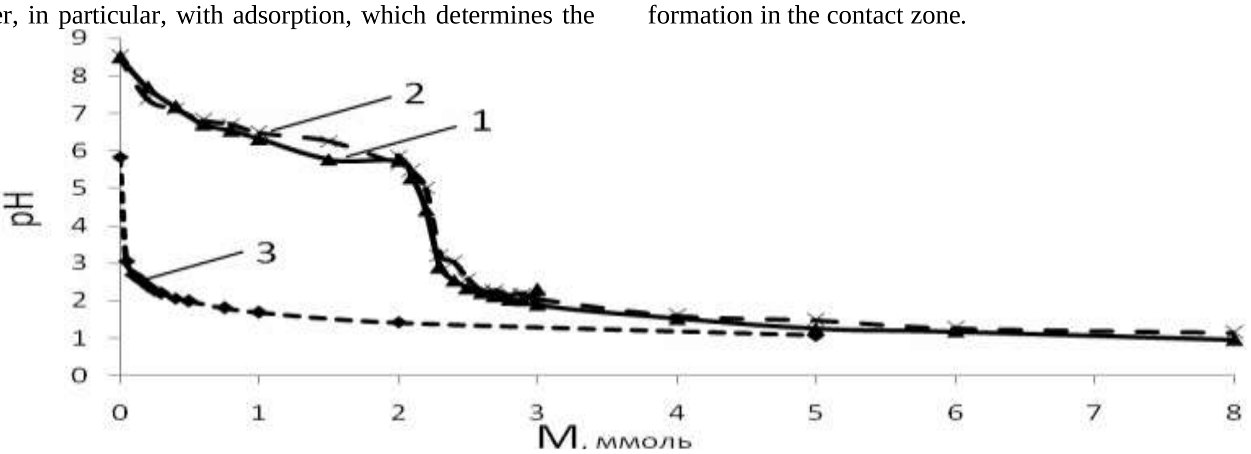

Fig.1. Dependence of the change in the strength of coatings on the temperature of hardening. 1-70°C, 2-40°C, 3-20°C.

The graphic dependence of the change in the strength of the coating on the consumption of the binder of optimal concentration shows that at a flow rate of 1 l/m2 to 3 l/m2, the value of Pt is practically constant, from 3 to 5 l/m2 it increases, and a further increase in the consumption of the binder leads to a noticeable decrease, at the same time, the process of absorption of the binder into the sand worsens, which leads to its spreading on the surface of the sand. At the same time, sand samples from different regions of the Aral Sea region, treated with a binder solution of various concentrations, were tested.

As a result of the research, it was found that the samples treated with a binder containing the preparation "AMU-2" - 12% have the greatest stability of the structural and mechanical properties of the system to the effects of external loads in the temperature range from 20°C to 80°C. In this case, the maximum values of the true plastic viscosity correspond to the minimum values of the elastic-elastic characteristics. The influence of various factors on the water resistance of the coating has been studied and the values of these factors have been determined. Under the influence of various atmospheric factors and their combination, the structure of the protective coating undergoes profound qualitative changes, which are determined mainly by changes in the properties of the binder.

Change in the plastic strength of the protective coating formed in the sands by impregnation of the AMU-2 preparation of the optimal concentration after testing the samples exposed in the IP-1-ZM and Feitron artificial weather apparatus for 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 by the end of the first 20 exposure cycles reaches a value of 5.28 MPa, a further increase in the strength of the polymer-sand crust is less intense and reaches a maximum value by 40 test cycles, then a drop in strength is observed. Tests have shown that 20 and 40 exposure cycles, sustained by the samples, correspond to 1-2.5 years of operation of the polymer-sand crust in natural conditions, which is quite consistent with the requirements for it.

После изучения процесса старения под действием комплекса факторов потребовалось установить роль каждого из них. Поэтому изучали изменение пластической прочности от действия тепла, кислорода воздуха и ультрафиолетового излучения. Данные показывают, что для материала защитного покрытия наиболее агрессивным фактором является температура окружающей среды, вызывающая за 300 часов теплового воздействия увеличение прочности почти в 13 раз, тогда как ультрафиолетовое облучение увеличивает Рт, лишь в 7,2 раза, а кислород воздуха - в 12 раз. С увеличением насыщенности потока твердыми частицами увеличивается интенсивность уноса.

CONCLUSIONS

Analysis of the obtained data on the study of the properties of the coating shows that the developed coatings are not inferior in their qualities to the existing coatings. Observations of the samples showed that when blowing with a wind-sand flow, first of all, protrusions and roughness are carried away from the impacts of the solid particles of the flow, and thereby there is a danger of the appearance of erosion centers. In these cases, after a certain blowing time, the samples begin to collapse.

Thus, the analysis of previous studies, as well as experimental work, indicate that the preparation based on lignin "AMU-2" developed by us is a potential organic resource when used as ameliorative materials for optimizing the agrophysical and chemical properties of soils, primarily in the territories adjacent to the Aral Sea and the Aral Sea.

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