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DEVELOPMENT OF NEW STRUCTURING POLYMERS FOR SOILS ARAL REGION

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ANNOTATION

The article discusses methods for developing new structure-forming polymers for soils in the Aral Sea region. The main problem is the consolidation of saline sands of the drained bottom of the Aral Sea, the creation of durable surface structures that do not interfere with plant growth and protect against weathering due to strong aerodynamic flow, is the most pressing problem of modern polymer chemistry and ecology in general.

KEY WORDS: *Aral Sea, dried bottom, problem, ecology, polymer, soil, Aral region.*

The problem of drying up the Aral Sea is a global problem of our time. This problem is aggravated by the fact that the shifting sands of the drained bottom of the Aral Sea are highly saline and 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 environmental situation in the Aral Sea region is the removal of salts and dust from the territory of these areas [1].

In this context, the problem of fixing saline sands of the drained Aral Sea bottom, creating durable surface structures that do not interfere with plant growth and protect against weathering due to strong aerodynamic flow, is a pressing 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 mobile sands with an area of more than 2,400 thousand hectares. The content of water-resistant macrostructures in them greater than 0.25 mm, which are important for the cultivation of salt-resistant plants on these sands, is insignificant and often amounts to no more than 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 securing sand from wind erosion through the creation of a strong surface crust, which ensures the fixation of mineral particles and salts in places of their formation in order to prevent deflation, is important [3].

In this aspect, the goal of our recent research work is to protect shifting sands from wind erosion by chemical fixation using high-molecular composition additives obtained from industrial waste from chemical enterprises of our republic.

In this regard, we have conducted research on the synthesis and development of technology for the production of water-soluble polymers based on methacryloyl chloride (PAMU-1) and epichlorohydrin (PAMU-2) with phosphorus-containing compounds obtained from the waste of JSC Maham-Ammophos, because . It is known from the literature that these monomers easily enter into an electrophilic substitution reaction with such electropositive centers as nitrogen and phosphorus. The latter predetermined the opportunity to study the behavior of new polymers as a soil structure-former and sand fixer.

Creating an artificial structure in soils using water-soluble polymers changes their physical, agrochemical and other properties, which helps increase crop yields. The filtration properties of the soil are of particular importance. A study of water filtration through a structured soil layer showed that increasing the dose of polymer helps accelerate this process. Thus, for typical and light gray soil (a layer of three-year-old and old cotton crops), the filtration rate increased 4 times with an increase in polymer dispersion by 10 times. Significant accelerations in the passage of structural soil are observed when studying filtration and absorption by the capillary rise method (Table 1).

It has been shown that the height of the structural layer of the soil plays a significant role in the absorption process. It was maximum with a 5-cm structural soil layer. The greatest increase for water was observed at a dosage of 0.5% polymer to a sample of soil. The effect of the polymer turned out to be somewhat weaker than the polymer, which is in good agreement with the value of the filtration coefficient. The effect of increasing the rate of filtration and water absorption with increasing polymer content in the soil and the height of the artificial structured soil layer depends on the degree of dispersion of the initial sample.

Table 1.
Dependence of some applied soil properties on the amount of polymer and the height of the structured soil layer

Концен трация в почве,%	Высота от структурен-ного слоя, см	Засоленная почва Приаралья				Светлый серозем (богара)			
		ПАМУ-1		ПАМУ-2		ПАМУ-1		ПАМУ-2	
		B	*υ/t*	*B*	*υ/t*	*B*	*υ/t*	*B*	*υ/t*
0	0	110	1,2	118	1,4	92	2,8	96	3,0
0, 5	3	76	4,6	82	5,4	72	4,2	68	3,6
0, 5	5	60	6,2	68	6,0	58	5,4	48	4.8
1,0	3	72	3,5	76	4,2	70	6,4	62	4,9
1,0	5	46	6,8	54	7,2	44	6,6	40	6,2
1,5	3	64	4,2	66	4,6	66	6,8	64	5,0
1,5	5	32	8,4	42	8,0	34	8,6	36	7,4

As dispersion increases, the rate of filtration and water absorption decreases. This is understandable - as the size of the aggregates increases, the porosity increases, which causes the rapid passage of water from top to bottom. The latter, as shown in laboratory tests, helps remove water-soluble salts present in the soil. It should be added that after repeated tillage of the soil, the artificial structure created with the help of the polymer is preserved (Table 2).

Thus, it has been established that under the influence of polymer preparations of the PAMU-1 and PAMU-2 series, water permeability, absorption and capillary rise of water increase. In combination with surfactants, on the contrary, these properties are suppressed the more, the higher the dose of the surfactant. When structuring the soil with developed polymers, moisture evaporation during watering from below decreases compared to the control. With increasing surfactant content, this decrease becomes even more noticeable (2-3 or more times). We investigated the effects of the water polymers we developed on the physical evaporation of water from water. Experimental studies have shown that if we take evaporation in the control variant as 100%, then the PAMU-1 polymer reduces it by 40.2%, and the PAMU-2 polymer by 34.6%.

Table 2
Effect of PAMU-1 polymer on the cleaning of saline soils

Почва	Количество полимера в почве	Водопрочные агрегаты			Размер отструктуренных агрегатов, мм
		До рассолонения	осле ссолонения	Сохраняемость, %	
Засоленная почва Приаралья	0,5	12,8	заливается	-	-
	1.0	34,3	18,6	18,2	4,0-0,2
	1,5	54,2	32,4	38,4	6,2-0,2
Светлый серозем	0,5	24,4	заливается	-	-
	1.0	46,2	28,4	36,6	8,0-0,2
	1,5	60,2	32,6	50,2	12,4-0,2

In other words, the influence of the developed polymers on the soil has a beneficial effect the following year. One of the important properties of soil is its ability to swell in the presence of moisture. We conducted studies of the swelling processes of various soils in our republic. At the same time, we gave priority to soil imported from the Aral Sea region.

Conducted studies of the nature of swelling and the process of disintegration of lumps in structured soils using optical methods, depending on the concentration of the developed polymers, showed that when the structural aggregate is enlarged at the same concentration of the PAMU-1 polymer, the number of cycles (periodic moistening and drying at air), in which they retain their structure, increases in each cycle, the change in the size of the lumps when they are moistened and then dried passes through a maximum. A study of the soil of the Aral Sea region treated with ordinary water showed that its lumps are not waterproof and, under the influence of the disjoining pressure of capillary water, quickly collapse, breaking up into small particles. When treating the soil with a polymer solution imported from the Aral region, the aggregates become more durable and retain their shape for a long time.

Determination of the swelling of structured soil treated with a polymer solution with water by a microscopic method showed that when structured soil interacts with water, the polymer film located on the surface of the soil particle swells first.

When interacting with water, the polymer film that envelops the soil particle becomes swollen, and the size of the lumps is larger than the original one. After the water evaporates, the swollen lump has a loose appearance, decreases in volume and practically retains its original size. A comparison of data from microscopic studies of the swelling of structured soils with the results of microaggregate formation in soil dispersions under the influence of a structure-forming polymer allows us to conclude that when a solution of the polymer we developed is introduced into the soil, along with microaggregate formation, stabilization of large aggregates occurs, which are enveloped in a polymer film, as a result of previously non-water-resistant units gain strength. The creation of sufficiently strong aggregates in structured soils contributes to a significant reduction in irrigation erosion, i.e. soil erosion.

LITERATURE

1. *Allamuratov M.O., Yesimbetov A.T., Ametov Ya.I. - New methods and reagents for fixing moving sands of the dried bottom of the Aral Sea Chemical industry, 2017.*
2. *Zhumabaev B.A. Study of the influence of new additives on the structure formation of saline sands / Sb.resp. scientific and technical conference of graduate students, doctoral students and applicants. T. 2007, pp. 104-107.*
3. *Karimov I.A. Uzbekistan on the threshold of the 21st century. Guarantees of stability and security threats. T. Uzbekistan - 1997*
4. *Mukhamedgaliev B.A. Ecological problems of the biosphere // Ecological Bulletin of Uzbekistan". No. 1, 2011 - P. 10-12.*