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METHOD FOR PRODUCING STABLE GEOECOLOGICALLY STABLE SOIL MIXTURES BASED ON DRILLING.

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Key words: drilling, inductively coupled plasma, atomic emission spectrometry, IR spectrometry, titration, sedimentation, density, pycnometric method, compression method, deformation modulus, chemical, toxicological and physical properties.

Annotation: An analysis of the scientific, technical and patent literature was carried out, reflecting the current state of the problems of pollution of natural geosystems by the placement of drilling waste and drill cuttings, and an analytical review was prepared, the properties of the studied raw materials were studied, and the research methods and methods of conducting experiments were also described. The studies were carried out by chemical methods (atomic emission spectrometry with inductively coupled plasma, IR spectrometry, titration, precipitation), X-ray phase, microstructural analysis and physical and mechanical (moisture, liquid and moisture at the rolling boundaries) methods of determination. , shear ring density, pycnometric method, compression modulus) and toxicological characteristics (biotest using methods for determining the toxicity of aqueous extracts by changing the mortality and productivity of daphnia and changing the level of chlorophyll fluorescence. the number of algae cells). Mathematical processing of experimental data was carried out using special software using basic statistical methods and laws.

soil were used to obtain soil mixtures that meet environmental requirements, to create elements of engineering structures and environmental protection measures. polybond stabilizer . Polybond soil stabilizer is a dark brown watery liquid containing surfactants preserved in sulfuric acid and citrus oil, with water-reducing, superplasticizing, polymeric properties in construction to change the water-physical properties of soils.

The results of a study of the chemical-toxicological and physical characteristics of samples of drill cuttings from oil fields in Western Siberia are presented (Table 1). The factors that can influence the toxicity of borage cuttings are considered . The parameters of the boreholes are determined, their regulation makes it possible to obtain a building material with a set of necessary properties. An assessment was made of the possibility of using drill cuttings to obtain soil mixtures. The calculation of environmental and economic damage was carried out.

It has been established that the main components present in all drill cuttings samples are silicon dioxide, aluminum and calcium oxides. The amount of oil products in the studied samples of drill cuttings does not exceed 10 g/kg . The amount of heavy metals (nickel, zinc, copper, chromium, etc.) in most drill cuttings samples does not exceed the established MPC (MPC) values for soil. Calcium carbonate was found in almost all samples. The main differences in the composition of aqueous extracts of individual samples are their mineralization (content of dry residue, potassium, sodium and calcium chlorides) and pH value. It has been established that all the studied samples belong to free-flowing clays with a large amount of dust and silty particles and moisture content above the yield point.

Table 1

Generalized characteristics of the studied drill cuttings samples

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Name of the indicator	Content Range	Name of the indicator	Content Range
Solid phase properties		Water Extract Properties	
Losses from fire,%	4.75-21.5	pH, units pH	7.61-11.53
Silica, %	45.8-74.8	Chlorides, mg/kg	90.5-42988
Aluminium oxide, %	6.28-14.5	Sulphates, mg/kg	30-3545
Calcium oxide, %	2.51-8.21	Bicarbonates, mg/kg	364-1547
Magnesium oxide, %	2.23-3.27	Carbonates, mg/kg	130-668
Sodium oxide, %	1.22-3.31	Calcium, mg/kg	25.7-1058
Potassium oxide, %	2.43-4.34	Magnesium, mg/kg	9.25-47
Copper, mg/kg	17.6-50.8	Potassium, mg/kg	7.19-33010
Nickel, mg/kg	20.5-57.2	Sodium, mg/kg	258.5-5273
Chromium, mg/kg	50.7-	Dry residue, mg/kg	7600-
Manganese, mg/kg	322-1211	physical characteristics	
Zinc, mg/kg	46.4-	Humidity, %	37.3-88.1
Oil products, mg/kg	180.4-8620	Humidity at the border liquid, %	28.2-45.7
Grade		Humidity at the border rolling stock, %	8.7-21
Sand particles, %	22.01-	Soil density, g / cm 3	1.49-1.84
Dust particles, %	14.70-50.99	Density of soil particles, g / cm^3	2.71-2.73
Clay particles, %	28.64-	Dry soil density, g/cm	0.851-1.34
Bioanalysis of aqueous extract			
Risk class	IV-V		

Using the calculated and experimental data to determine the risk class, the contribution of individual components of the drilling plume composition to the overall risk level was evaluated. Based on the results of counting and biotesting of samples using test objects (lower crustaceans Daphnia) magna Straus and green protococcal algae Scenedesmus guadricauda (Radis. Ed.). 9 it is established that the environmentally hazardous class V drill cuttings are stored up to 33.5 g/kg of dry residue in the water extract and 7.08 g/kg of oil products.

The environmental load on the components of the environment from the impact of drill cuttings is estimated. An assessment of the damage caused to the soil as an environmental object showed that the damage from the placement of 1 m 3 of drilling plumes is 2,000 rubles, and the annual environmental and economic damage to soil when drilling wells in Western Siberia is more than 2,000 rubles. than rub. 2.5 billion rubles At the same time, taking into account the placement of drill cuttings in sludge pits or landfills, soil degradation will occur on an area of more than 350 hectares.

An assessment of the possibility of using drill cuttings in construction showed that a large amount of clay particles and salts, high pH values, high humidity directly from them are used as soil for the construction of underground elements, the placement of oil and gas facilities. it is impossible to isolate structures, shelters and waste. However, the presence of rock-forming components, heavy metals, oil products in the composition of the drill cuttings indicates the possibility of obtaining products with soil

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mixtures as a result of the development of technological solutions and requirements for soil mixtures. set of desired features.

Ensuring environmental and structural sustainability by complying with the geo-environmental sustainability of drill cuttings production and requirements for artificial soils for the creation of engineering structures and environmental measures can be defined as assurance.

science-based requirements for soil mixtures in terms of chemical, toxicological and physical-mechanical properties and the optimal composition of soil mixtures based on drill cuttings are proposed.

This is ensured by compliance with the requirements for the pH content

As the maximum permissible amount of oil products in the soil mixture, the residual amount of oil products in the soils of the Khanty-Mansiysk Autonomous Okrug-Yugra is 5 g/kg for construction land, which is 30% less. Experimentally determined maximum value for risk class V.

Since the content of heavy metals in samples of drill cuttings does not exceed the permissible values, then for soil mixtures based on drill cuttings, drill cuttings in any ratio: sand, an additive to the permissible content of heavy metals in soil, the requirements are met.

of the addition of the soil stabilizer Polybond on the regulation of the pH of water extracts was studied (Picture 1). Research has shown this.

The dependence of pH on stabilizer dosage in the pH range of 8 to 6 is weak in all cases. After

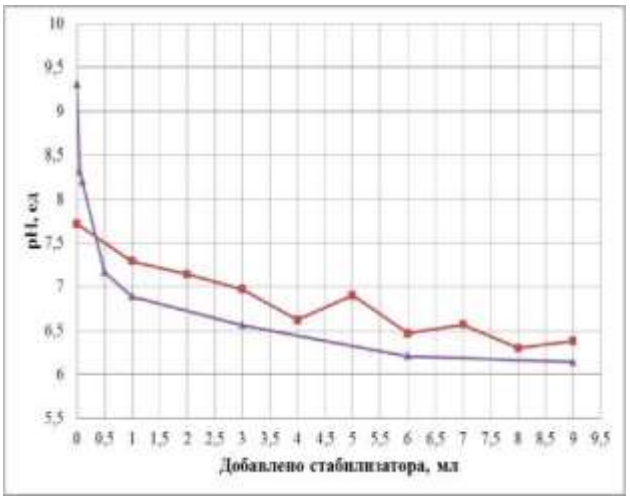

Рисунок 1 - Образцы бурового шлама (№№ 3, 6) после 48 часов контакта с раствором стабилизатора грунтов

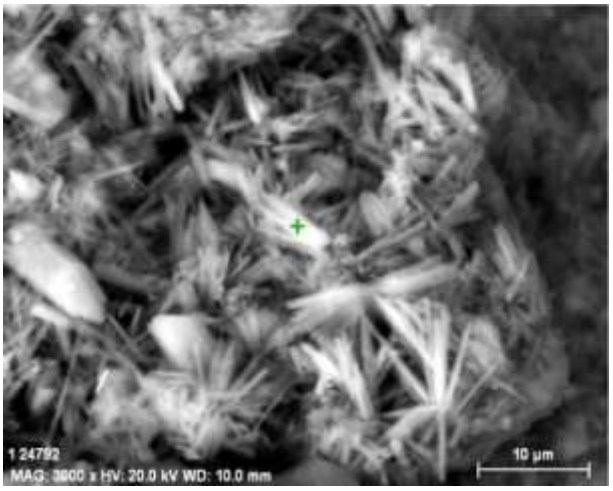

Рисунок 2 - Кристаллы гипса на поверхности бурового шлама, обработанного стабилизатором грунтов

neutralization of soluble alkaline substances, the stabilizer begins to react with the components of the solid phase, which exhibit buffer properties. It has been established that a chemical reaction takes place with the formation of gypsum crystals when the stabilizer containing sulfuric acid interacts with calcium carbonate, which is present in sufficient quantities in the drill cuttings (Fig. 2). Recommended pH ranges = 6.0-8.8.an assessment was made of the inflow of pollutants from the bed of an engineering structure into the surrounding soil in a horizontal direction due to processes. In calculations, the value of 10 g/kg was taken as the allowable amount of salts in the soil cover, which, according to literary sources, corresponds to the environmental hazard zone.

The problem of the ejection of soluble salts in the horizontal direction has an analytical solution that determines the concentration of salts depending on the distance.

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from the axis of the engineering structure and the temporary canvas (1):

Where

C_0 - initial concentration of salts,

h - distance from the axis to the boundary of the engineering structure,

x - distance from the axis of the engineering structure,

D is the diffusion coefficient,

this time,

erf is the error function defined by the expression: $\operatorname{erf}(y) = \frac{2}{\sqrt{\pi}} \int_0^{years} e^{-z^2} dz$.

The solution of the diffusion equation showed that the saline zone outside the canvas appears when the amount of salts in the soil mixture doubles compared to the allowable content. The maximum width of the contaminated zone and the average concentration of salts in soils increase with an increase in the kurtosis coefficient. At the same time, even if the amount of salts in the soil mixture is 10 times greater, the maximum width of the pollution zone does not exceed 20 m, and the average salt content in the pollution zone for the entire period of existence. does not exceed the allowable value by 1.4 times.

Modeling and evaluation of the release of soluble salts from the bed of an engineering structure from soil mixtures based on drill cuttings, as well as the study of the effect of soil mixtures with different salt content on living organisms in biotest experiments showed that. when its content in the soil mixture is less than 20 g/kg, it does not adversely affect the soil ecosystem and does not reduce its environmental resistance to technogenic impacts.

The structural stability of soil mixtures based on drilling plumes is ensured by compliance with the requirements for materials when they are used to create elements of engineering structures and carry out environmental protection measures.

In order to determine the allowable share of drill cuttings in the soil mixture, model calculations were made for diluting drill cuttings with sand. Calculations showed that the ratio of drill cuttings:sand should be from 1:0.7 to 1:3.5, depending on the content of clay particles in the cuttings (26-45%).

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