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# PRODUCTION OF CERAMIC DRAINAGE PIPES IN UZBEKISTAN

***Abstract***: *The role of ceramic drainage in determining the aridity of land and increasing productivity in the Republic of Uzbekistan. To create an abundance of agricultural products, a number of measures are required, among which reclamation occupies an important place.*

***Key words***: *drainage, land reclamation, productivity, agriculture.*

***Language***: *English*

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## Introduction

This task envisages assistance in the drainage of excessively wetlands, irrigation and watering of lands in arid regions, as well as the expansion of existing irrigated agriculture and sown areas. The method of draining waterlogged and swampy lands, in which excess water from the soil is discharged by gravity into rivers, lakes or other underlying water bodies, is called drainage. Drainage, lowering the level of excess water, creates the most favorable water and air thermal regime of the soil for plants and thereby contributes to an increase in crop yields.

At present, the device of closed horizontal drainage on the saline lands of Central Asia is carried out mainly from bell-shaped pottery pipes with filtering sprinkles from sand-chan-gravel mixture. Along with its advantages, this design has a number of disadvantages. The technology for making pottery pipes is complex and time consuming. Specialized factories for the production of ceramic pipes and quarries of sand and gravel mixture, with the required fractional composition, are often located quite far from the work sites, which greatly increases the cost of the drainage device and, in addition, the very design of the drainage from tight butted pipes with filter packing is not enough effective in terms of creating the necessary soil water regime.

Drainage ceramic pipes are a kind of piping elements. Their main feature is the use of plastic clay as a raw material for production. They can be made in various configurations, depending on the geometric shape of the cross section. The product is classified into: standard cylindrical with a round cross section, hexagonal and octagonal. In this case, the internal through-hole for the passage of the medium is always circular. The quality standard for these products is the technical conditions, which are regulated in GOST 8411-74 [8,9].

Drainage is called open when it is made in the form of ditches, and closed when it is made in the form of underground pipelines. Closed drainage is more perfect and progressive than open drainage. Of particular importance is the construction of closed drainage systems under conditions of irrigation of saline soils in Central Asia and Uzbekistan. Irrigation is used here not only for plant nutrition, but also for desalination of the upper layers of the soil, from which salts are washed out, which contributes to an increase in soil fertility. In the absence of drainage, irrigation raises the level of groundwater, which becomes saline due to the migration of dissolved salts of the underlying soil layers and, rising to the upper soil layer, salts are again deposited in it. In the republics of Central Asia and Uzbekistan, large tracts of irrigated land are not used due to their salinity and waterlogging[10].

The main raw materials for the production of ceramic drainage pipes are low-melting clays or mixtures of various low-melting clays with or without additives. The main property of clay is plasticity, i.e. the ability in a wet state, under the influence of an external force, to take a given shape without breaking and to maintain this shape after the cessation of the external force. For the manufacture of pipes of small diameters (50-100 mm), clays must have a plasticity number of at least 7-15 (according to GOST 9169-75), i.e. belong to the group not lower than "moderately plastic raw materials". As for pipes of large diameters (125-250 mm), their production requires clays belonging to the group of "medium plastic raw materials" with a plasticity number of 15-25. Clays should be fine-grained, dispersed and contain clay particles (less than 0.005 mm) at least 20-25%, and dusty particles (0.005-0.05 mm in size) no more than 40-50%. If the dusty particles are more than 40-50%, then such clay is low-plastic and for the manufacture of drainage pipes (especially large diameters) it is necessary to add more plastic clays to it [1,2].

They must have good drying properties, i.e. dry quickly without cracks and warpage, with an air shrinkage of no more than 7-8%. In terms of chemical composition, clays suitable for drainage pipes of small diameters are predominantly acidic, i.e. contain less than 14% $Al_2O_3$, and for pipes of large diameters they are usually semi-acidic, i.e. contain $Al_2O_3$ more than 14%. Clays and loams used in the production of drainage pipes are usually fusible, with refractoriness below 1350$^o$C with water absorption of the shard of more than 5% [3,4,5].

Reclamation is a system of organizational, economic and technical measures aimed at improving the unfavorable natural conditions of lands used in agriculture, mainly as a result of changes in the water regime. The water regime is changed by drainage (drainage) or irrigation (irrigation) of the soil.

In our country, in the countries of Central Asia, as well as in the CIS countries, there are tens of millions of hectares of bogs and loamy arable land, subject to excessive spring moisture and in need of drainage work. Drainage of swamps and wetlands in the Baltics, Belarus, Ukraine, Russia, the Caucasus, the Far East, Central Asia and Uzbekistan is of great economic importance.

Drainage systems are also used in industrial and urban construction to protect various structures, underground parts of buildings and communications from flooding by groundwater.

Ceramic drainage pipes have found the greatest application for the construction of closed drainage systems. The reliability and service life of these pipes are very high and they began to be used long ago.

However, only after the 30s of the last century, great opportunities opened up for the introduction of various reclamation measures in the country's agriculture.

After gaining independence, in the main directions of economic and social development, it is planned to ensure the further development of land reclamation, to commission hundreds of thousand hectares of irrigated and drained land, to water hundreds of hectares of pastures in desert, semi-desert and mountainous regions.

**Materials and Methods**

From the above, the relevance of organizing the production of ceramic drainage pipes in sufficiently large quantities is visible.

Drainage of bogs and lands by drainage with lowering water pounds to a certain level from the surface makes it possible to productively use lands for agricultural purposes, increases productivity, promotes air penetration into the soil and intensifies its oxidation, and also increases the assimilation of nutrients contained in the soil by plant rhizomes.

Wetlands contain large reserves of essential plant nutrients, and drainage allows these reserves to be used. The yield on drained land is 2-3 times higher than that on old arable land. To lower an unnecessarily high level of groundwater, two methods of drainage are mainly used - open and closed [6,7].

Acidic clays containing less than 15% A120z are suitable for the production of drainage pipes of small diameters, and semi-acidic clays containing from 15% to 23% AI2O3 are suitable for the production of large diameter pipes. Clays should have good drying properties, air shrinkage of clays should not exceed 7-8%. Clays and loams should be non-caking, with a water absorption of the shard of more than 5%. Fire shrinkage of clays during firing up to 950-1000 ° C should be no more than 1-2%.

The content of limestone inclusions in the clay in the form of individual grains larger than 1.5 mm is unacceptable, as well as stony inclusions and plant fibers.

In order to achieve this goal, we have developed new compositions of ceramic drainage pipes based on local raw materials. Optimal charge compositions of experimental laboratory masses are shown in Table 1.

**Table 1. Optimal charge compositions of experimental laboratory masses**

| Components | Pipe diameter (mm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 50 | 75 | 100 | 150 | 175 | 200 | 225 | 250 |
| Clay Angren | 80 | 77 | 75 | 70 | 70 | 70 | 65 | 60 |
| Kaolin AKT-10 | 10 | 13 | 13 | 15 | 13 | 10 | 15 | 20 |
| Fireclay | 10 | 10 | 12 | 15 | 17 | 20 | 20 | 20 |

Physicomechanical parameters of experimental laboratory samples are shown in Table 2.

Considering the absence of drainage pipe production plants in the Republic, as well as poorly established production of drainage pipes in neighboring countries, to raise the issue of its own development of drainage pipes production in order to import substitution and export of products based on local raw materials. From the given data it can be seen that the obtained experimental laboratory samples meet the requirements of GOST.

**Table 2. Physico-mechanical properties of experimental laboratory samples**

| Indicators | Pipe diameter (mm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 50 | 75 | 100 | 150 | 175 | 200 | 225 | 250 |
| Shrink, % | 7,0 | 7,2 | 7,5 | 7,7 | 8,0 | 80,5 | 80,7 | 80,9 |
| Water absorption, % | 11,0 | 11,2 | 11,4 | 11,0 | 11,0 | 10,7 | 10,7 | 10,7 |
| External load, kN | 3,5 | 4,0 | 4,5 | 5,0 | 5,3 | 5,7 | 6,0 | 6,3 |
| Strength, kN | 5,5 | 6,0 | 6,5 | 7,0 | 7,5 | 8,0 | 8,5 | 9,0 |
| Frost resistance, cycle | >25 | >25 | >25 | >25 | >25 | >25 | >25 | >25 |
| Firing temperature, °C | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 |

**Results and Discussion**

Analysis of the data obtained showed that overburden, in accordance with the radiation safety standards, can be used without restrictions for the production of all types of building materials. The content of noble and rare-earth elements in the overburden is relatively small and is of no value for their industrial extraction. The amount of environmentally hazardous elements (lead, vanadium, arsenic, chromium, antimony, gallium, mercury, etc.) is below the maximum permissible level and, in general, characterizes the rocks as a relatively environmentally friendly raw material. The data obtained were compared with the content to be quantified. The quality of finished ceramic products obtained from coal mining wastes is greatly influenced by the physical and mechanical properties and the chemical and mineralogical composition of the overburden. The main physical and mechanical properties of overburden are density, natural moisture content, compressive strength and porosity.

Analysis of the obtained data on density shows that it decreases from horizon +50 to horizon +150 n. At the same time, the density of siltstones is 7-10%

higher than the density of mudstones and is 2.3-2.7 g / ch3 for mudstones, 2.6 g / ch3 for light gray mudstone. Natural humidity for mudstones ranges from 4.9 to 5.8%. siltstones 4.3-4.7% and increases from the horizon +50 to the horizon +150 m. Natural moisture content for light gray mudstones was 4.8%. The compressive strength of the overburden is 34.7-37.4 MPa for mudstones, 45.0-43.9 MPa for siltstones, and 45.6 MPa for light gray mudstones. When the horizon of the bedding of rocks changes from +50 to +150, and a decrease in the compressive strength of siltstones and mudstones is characteristic. The porosity of mudstones is 12.9-18.7% of siltstones 10.6-19.1% and increases depending on the bedding horizon from +50 to +150 m. The porosity of light gray mudstone is 15.6%.

Analyzing the data of chemical analysis of overburden rocks of various lithological types, one can judge the quantitative content of rock-forming oxides (Table 2.3). The content of silicon oxide SiO2 is 56.7-61.3%. It is in a bound and free state. Bound silica is a part of clay-forming minerals, freely represented by impurities of finely dispersed quartz, its content in samples is 16-25%. According to the content of free quartz, coal mining wastes belong to the group of raw materials with an average quartz content / 102 /. Aluminum oxide A12 03 is a part of clay-forming minerals and micaceous impurities. Its content for mudstones is 17.6-18.4%, for siltstones 17.6-18.5%, for light gray mudstones 17.9%, decreases for mudstones depending on the bedding horizon from +50 to +150 m According to the content of aluminum in the calcined state, the rocks belong to the group of semi-acidic raw materials. The content of iron oxides in the studied samples is 5.6–6.4% for mudstones, and 3.4–4.18% for siltstones. Iron compounds are represented by pyrite and siderite. Overburden rocks in terms of iron oxide content belong to the group of raw materials with a high content of coloring oxides. Alkaline earth metal oxides are found in clay minerals and carbonates. The total content of calcium and magnesium oxides is 1.67-2.3% for mudstones. for siltstones 1.09-1.84%.

**Conclusion**

The total content of sodium and potassium oxides in lithological types of various horizons ranges from 2.96 to 3.36%. Alkaline oxides are part of clay-forming minerals, and are also present in impurities in the form of water-soluble salts. The content of sulfur oxide S03 does not exceed 0.28%, which is typical for low-sulfur environmentally friendly raw materials and allows the use of overburden in the production of ceramic products without restrictions. In addition, overburden contains organic carbon, which ranges from 3.5 to 5%.

As a result of studying the regularities of changes in the composition and properties of coal mining waste as a raw material for the production of ceramic building materials, the following was established: - according to radiation safety standards, coal mining waste can be used for the production of all types of building materials without restrictions, the amount of potentially toxic elements in waste does not exceed the maximum permissible concentrations which characterizes them as environmentally friendly raw materials; - the physical and mechanical properties of coal mining waste change downward from the horizon + 50m to the horizon + 150m, which is explained by a decrease in the degree of compaction and more significant weathering; in terms of chemical composition and content of water-soluble salts, coal mining wastes are close to clay raw materials and belong to the group of semi-acidic raw materials with a low content of coloring oxides; - during the thermal treatment of coal mining waste, transformations occur, associated with the dehydration of kaolinite, a change in the crystal structure of minerals with the formation of new phases. Based on the above, it can be concluded that coal mining wastes are close to traditional clay raw materials in terms of their physical and mechanical properties, chemical and mineral composition and can be used for the production of ceramic drainage pipes.

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