

**ANALYSIS OF THEORETICAL AND PRACTICAL RESEARCH ON THE
FILTRATION PROCESS IN UNCOVERED CHANNELS.**

**АНАЛИЗ ТЕОРЕТИЧЕСКИХ И ПРАКТИЧЕСКИХ ИССЛЕДОВАНИЙ
ПРОЦЕССА ФИЛЬТРАЦИИ В КАНАЛАХ БЕЗ ПОКРЫТИЯ.**

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Abstract. In the practice of hydraulic engineering, anti-seepage devices made of clay (hereinafter we will use this term as bentonite) soils (depressions, screens, cores, etc.) are widespread. When designing them, it is very important to correctly assess the permeability of the soil. Overestimation of this value leads to excesses in design and waste of material resources, and underestimation - to higher filtration losses. The latter is especially unpleasant for the case of shielding industrial waste storage facilities containing hazardous chemicals, the migration of which in greater than anticipated quantities can cause pollution of the surrounding area and to exclude it from economic use for a long time. The water permeability of soils is quantified by the value of the filtration coefficient. At present, the determination of the filtration coefficient of bentonite is often carried out on the basis of the results of relatively short-term (not more than one month) experiments, which may cause an undefined underestimation of their permeability. With a large area of industrial waste storage facilities (tens and hundreds of hectares) and a significant service life, an underestimation of the filtration coefficient even by one order of magnitude is fraught with significant errors in predicting filtration losses with all the ensuing consequences. Carrying out these studies is necessary, since there are no clear indications in the literature on the most expedient method for determining the filtration coefficient of low-permeability bentonite. Moreover, some authors even express doubts about the possibility of determining it directly, in connection with which they recommend calculating this important soil characteristic indirectly using data from other test methods.

Keywords: Bentonite, Logon , Water permeability, filtration, filtration coefficient, montmorillonite.

INTRODUCTION

The In the world, special attention is paid to targeted scientific research aimed at optimizing the structures of soil structures, determining the possibility of using local raw materials in their composition as a material to reduce filtration, developing methods to ensure the strength of soil structures by reducing the filtration processes of dams in soil structures. In this regard, one of the important tasks is the improvement of effective methods to reduce filtration processes, the creation of anti-filtration devices and the development of technologies for reducing filtration processes using local raw materials.

From the analysis of the scientific literature it is known that during operation of the soil structures postorenyh homogeneous soil occurs seepage water flow through the dam body s , while the conditions for the deformation of its body, to reduce the filtration flow is necessary to build special devices against filtration. As a result, the development of anti-seepage devices requires research on the efficiency of using local raw materials. When creating anti-seepage devices in individual soil structures, it is necessary to take into account the possibility of using local materials with low water permeability. The main reserve deposits of bentonite clay available on the territory of the Republic of Uzbekistan, such as Navbahor and Azkamar in the Navoi region, the Kattakurgan bentonite clay deposit in the Samarkand region and the Logon bentonite clay deposit in the Fergana region, can be used as a low permeable material. Based on the above analyzes, the goals and objectives of the work were determined.

In the study to determine the filtration coefficient of local raw materials of bentonite, the results of studies of its chemical composition, analysis of physical, mechanical and hydrodynamic properties are presented in order to determine the possibility of using bentonite as an anti-filtration material for dams of soil structures, as well as to determine the filtration coefficient of bentonite clay from the Logon deposit.

MATERIALS AND METHODS

In Uzbekistan, there are deposits of bentonite clay rich in various minerals, which are currently widely used in various spheres of the Republic. The Logon bentonite clay deposit was discovered in 2009 on the territory of the Kuvasay district of the Fergana region, and today in Uzbekistan it is considered the second reserve of raw materials for bentonite clays. The possibility of using bentonite clay as impervious material found in the construction of structures on soils include the Fergana region and to effectively use it as a rotivofiltratsionnogo material.

The content of bentonite clays, montmorillonite in bentonites of Logon of Fergana region ranges up to 66%. The rest of the clay minerals are mainly hydromica and slightly kaolinite. Logon's bentonite clays are light gray, greasy to the touch, soapy, soft, plastic. Logon's bentonites are alkaline.

In the ion-exchange complex of clays, alkalinity from 1.26 to 3.14 sharply prevails sodium over potassium, magnesium over calcium, i.e. in general they are sodium. Logona bentonites are the second industrialized alkaline bentonite object in the Republic. Their swelling capacity is 200-300% or more; upon activation, it increases several times. Bentonites contain high levels of potassium, phosphorus and more than 10 beneficial trace elements for plants. These properties clays logon allow them to be widely used as an ameliorant, saving irrigation water, and further as a natural, environmentally friendly, natural fertilizer - agroores in agriculture, primarily Ferghana valley.

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from economic use for a long time. The water permeability of soils is quantified by the value of the filtration coefficient.

At present, the determination of the filtration coefficient of bentonite is often carried out on the basis of the results of relatively short-term (not more than one month) experiments, which may cause an undefined underestimation of their water permeability. With a large area of industrial waste storage facilities (tens and hundreds of hectares) and a significant service life, an underestimation of the filtration coefficient even by one order of magnitude is fraught with significant errors in predicting filtration losses with all the ensuing consequences.

RESULTS AND DISCUSSION

Fractional analyzes were carried out to fully describe the structural properties of Logon's bentonite clay (Fig. 1). The size of the mineral particles contained in the sedimentary structure has a great influence on its physical and mechanical properties. In accordance with the classification of V.V. Ohotin, the composition of Logon's bentonite clay can be assigned to the group of clay rocks, since the content of particles $d < 0.005$ mm exceeds 30%.

In the studies carried out, the mechanical and chemical composition of bentonite clay was determined. It has been established that the chemical composition of Logon's bentonite clay consists of various chemical minerals, most of which is SiO_2 (54.62%).

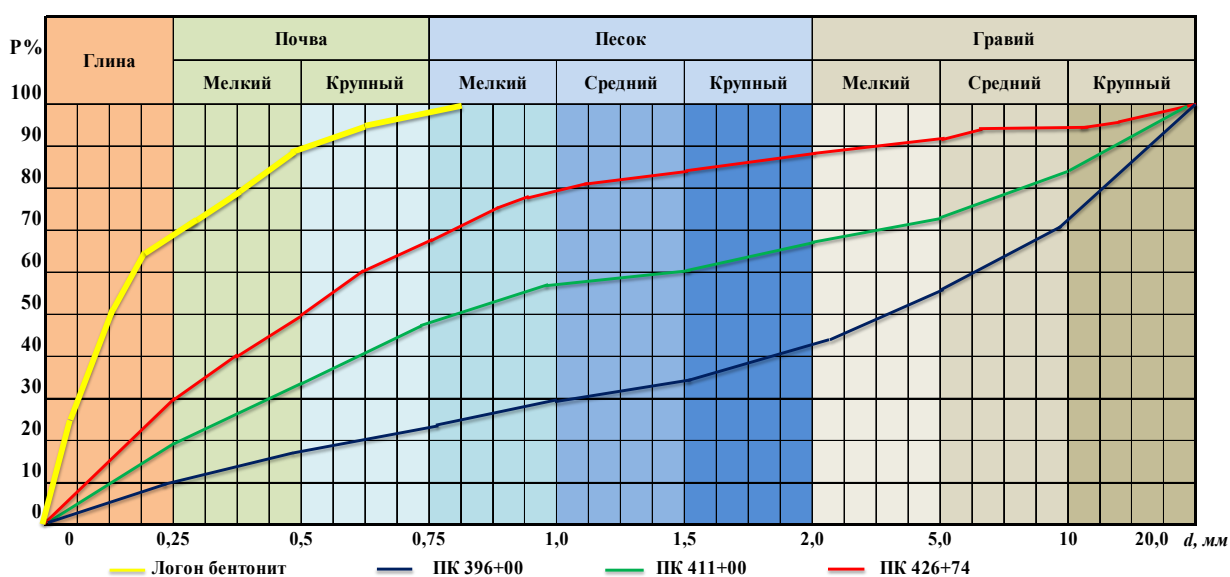


Fig. 1. Fractional composition of bentonite clay from the Logon deposit.

To achieve the set goals, taking into account the available hydraulic installations, an experimental device was built on the model according to the design type of the device N.V. Kolomensky. This device allows you to determine the filtration coefficient of bentonite clays with a damaged and undisturbed structure. Devices of this type are also recommended in accordance with GOST. To determine the filtration coefficient of Logon bentonite, an experimental device was used for N.K. Kolomensky, taking into account hydraulic devices.

The filtration coefficient K_f (cm / s) is calculated using the following formula:

$$K_f = \frac{Wl}{hFT} \quad (1)$$

here: W is the volume of water, cm^3 ; l is the length of the filtration path equal to the height of the soil layer, cm; h - head, cm; F is the area of the sample, cm^2 ; T - filtration time, s.

The experiments were carried out in accordance with GOST 25584-2016, as well as on the basis of available methods in modern literature. In an experimental study of the permeability of bentonite, repeated experiments were carried out at different values of the head.

In the course of experimental studies, water was passed under pressure to a sample of bentonite clay from top to bottom, and the draining of filtered water from the bentonite layer was observed. As a result of the study, the water from the bentonite layer was very pure, and this factor showed that bentonite has the ability to filter, that is, it can be used as a filter in various industries.

At the next stage of experimental studies, the pressure was supplied from the bottom upward from a sample of bentonite clay and from a layer of local soil.

At the next stage of experimental studies, samples of bentonite clay with a density of $\rho_d = 1600-1800 \text{ kg / m}^3$ were conducted under the pressure of water from the bottom up. Taking into account the swelling of bentonite clay, the sample and sand layers were fixed with clamps. Experimental studies were observed for 22-180 hours.

The filtration coefficient is established by drawing up a graph of the relationship between the coordinates $K_f = f(W / t \omega)$ obtained under the experimental conditions, (Fig. 2)

Based on the statistical analysis of the results of experimental studies (correlation coefficient $R = 0.96$), a new relationship was determined and obtained to determine the filtration coefficient of bentonite clay.

$$n_0 = 0,0552 \left(\frac{P_g}{P_b} \right)^{0,554}$$

A mixture of bentonite clay based on modified additives serves to facilitate the construction and technological process of bentonite clay. The main task of the polyacrylamide added to the bentonite granules is to increase the viscosity of the mixture. The purpose of adding a reagent is to slow down the settling of the mixture. The addition of calcium soda in certain quantities leads to the crushing of a large part of the bentonite due to alkalinity.

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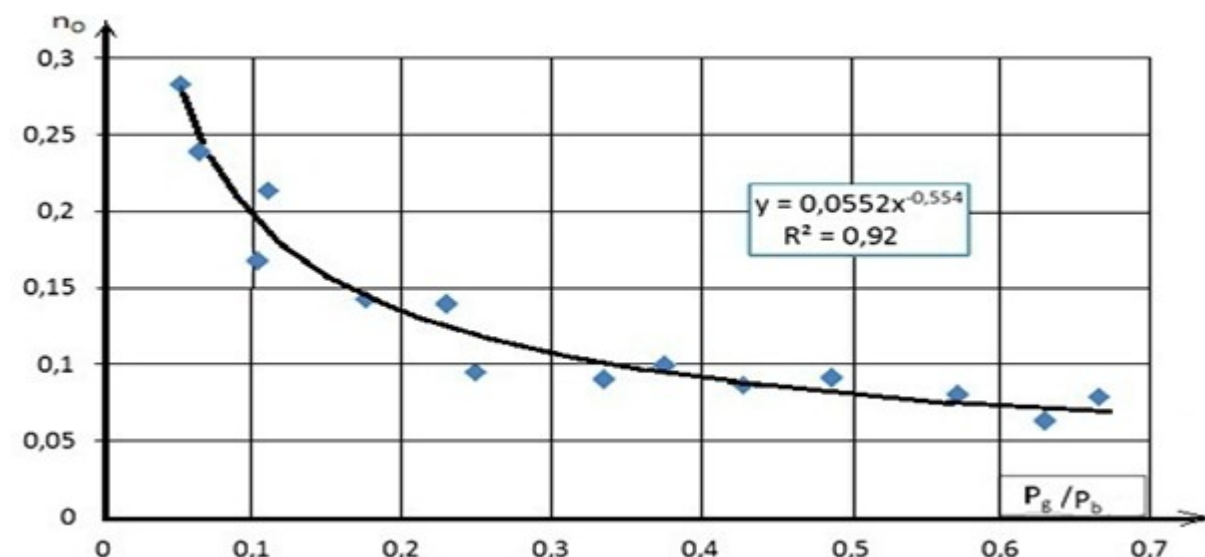


Fig. 2 . The graph of the relationship of the filtration coefficient $K_f = f(W / t \omega)$.

CONCLUSIONS

As a result of research on Logon bentonite clay in the Fergana valley, the following was revealed:

The filtration coefficient of Logon's bentonite clay, which was investigated in accordance with the average value of the results obtained, was $K_f = 0.38 \cdot 10^{-7} \text{ cm / s}$ ($3.46 \cdot 10^{-5} \text{ m / day}$) with an average value of $\rho_d = 1700 \text{ kg / m}^3$;

It was found that the average value of the filtration coefficient for the water permeability of bentonite is $K_f = 0.35 \cdot 10^{-7} \text{ cm / s}$ ($3.1 \cdot 10^{-5} \text{ m / day}$);

Based on the statistical analysis of the results of experimental studies (correlation coefficient $R = 0.96$), a new relationship was determined and obtained to determine the filtration coefficient of bentonite clay;

Based on the results of experimental studies, the possibility of using bentonite clay from Logon Fergana region as a material to reduce the filtration process in soil structures was recommended.

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