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Properties of Ceramic Brick from Lessovoid Suglines and Shally Dispersed Binders

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ABSTRACT: The article analyses the results of laboratory researches of obtaining qualitative waterproofing ceramic brick on the basis of low-grade loess like loam are resulted. Using the loess loam as the main raw material, scientific and theoretical foundations of the production of clinker brick have been developed. By applying the method of separation of dispersed systems in the processing of raw materials, a method for improving the technological parameters of the molding material is scientifically substantiated. As at the recommendation of a new way of preparation of weight it is reached improvements of parameters of process of formation of a brick.

KEYWORDS: clinker, loessial loam, plasticity, the binder obtained on the basis of loessial loam, the degree of clinkerizing, brocken brick, phase-composition, anorthite, cristaboleite, diopside, structure formation, exploitation properties.

I. INTRODUCTION

In the result of the dust which consists of mineral salts rising from the dried level of the Aral Sea it is perceived the change not only in the living nature, but also in the composition of raw materials in this region. In the result of it the change in the quality indices of products taken from them is observed. One of such products is the ceramic brick taken on the bases of local loam and loess soils[1-2].

II. SIGNIFICANCE OF THE SYSTEM

The article analyses the results of laboratory researches of obtaining qualitative waterproofing ceramic brick on the basis of low-grade loess like loam are resulted. The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

III. LITERATURE STUDY

A. Job satisfaction

As in production of such a material is associated with the use of high- quality raw materials [3], but there are a number of works that show the possibility of using low- grade clay materials in the process of producing high-grade ceramic bricks with the attraction of a number of modifiers in small quantities [4] due to the scarcity of the latter in the region of the South in the.

B. Work motivation

Aral Sea region in Uzbekistan, wall ceramic materials are produced on the basis of low-grade loess-like loams characterized, by low waterproofing salt-resistant properties analysis of the literature data [5] shows that the problems of developing a technology for producing a waterproofing salt-resistant ceramic brick and improving the methods of its production remove little attention.

IV. PROPOSED METHODOLOGY AND DISCUSSION

Currently, more attention is paid to increasing production rates and improving the quality of building materials, including building bricks. One of the most widely used building materials today is ceramic brick. In this regard, this article discusses the 8 improvement of the molding properties of loess loam of the Yarmyshsk field, located in the Khorezm region, the main quarry of the Dilshodkurilishgish joint-stock company, used to produce hydro- insulating

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solestable bricks determination of the chemical composition of the loam studied was carried out using classical methods [6], the results of which are shown in.

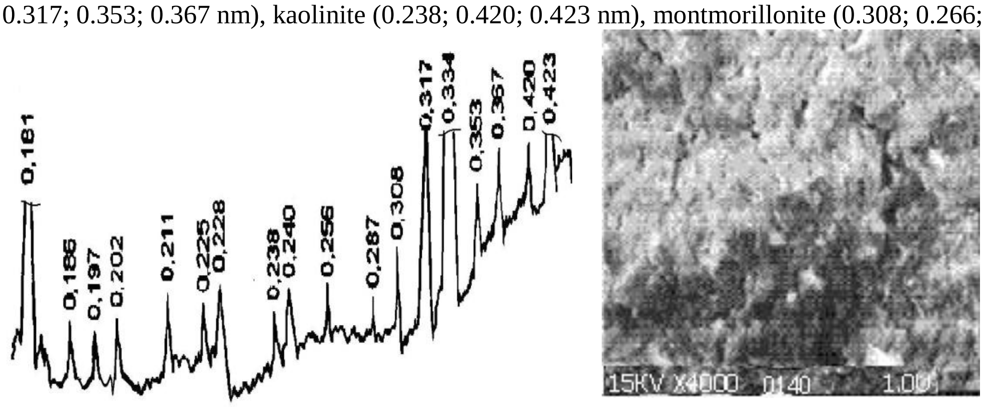
Table 1.Technical composition of loess loam from the Yarmish deposit

№ ele ments	The content of oxides mass prosents									
	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	p.p.p	Σ
1	52,75	11,92	0,56	3,91	16,52	2,70	0,49	2,33	1,43	7,38	100,00
2	59,20	11,20	0,45	5,67	13,52	3,07	1,6	1,88	1,02	2,39	100,00
3	53,75	11,92	0,56	3,91	16,52	2,70	0,49	2,33	1,43	7,38	100,00

According to the data obtained, the raw materials are acidic and colored, not plastic.

The results of the particle size distribution of the samples showed: 1.0-0.063-1.59%; 0.063-0.01-43.88%; 0.01-0.005-16.23%; 0.005-0.001-18.96%; less than 0.01-19.34%.

X-ray studies of the raw materials show (Fig. 1. a) that its composition contains: quartz (0.181; 0.197; 0.211; 0.240; 0.334; 0.423 nm), gypsum (0.185; 0.197; 0.211 nm); hydromica (0.202; 0.225; 0.287; 0.317; 0.353; 0.367 nm), kaolinite (0.238; 0.420; 0.423 nm), montmorillonite (0.308; 0.266; 0.353 nm).



a) b)

Fig 1. X-ray and electron microscopic images of loess loam of the Yarmish Koye Field

The obtained electron microscopic images (Fig. 1. b) show that isometric flakes are available forming positions, include montmorillonite, and rhombic carbonates. The differential thermal analysis carried out indicates that the samples of the initial raw material undergo a number of changes when heated at a temperature of 90 ^{o}C, an 15 endothermic effect is observed associated with the evaporation of hygroscopic moisture. The exothermic effect is observed due to burn up of the contiguous ones at 325 at 560 ^{o}C evaporation of water of crystallization occurs Due to the de-carbonation in the temperature range of 840-890^{o}C, an endothermic effect is observed weight loss is 15.0%. g Studies of the technological properties of the raw materials have the following data, which are shown in

Table 2. Ceramics-technological properties of the initial loess-like loam of the Yarmish Koye field

Fire resistance	Atterberg plasticity	Aerial whiskerage	Chayevosvitel nost to drying	Compressive strength MPa	Bulk weight kg/m^3
1100	6,95	4,01	180	2,11	1425

The type of clay raw material determines its behavior in drying. Selected raw materials are highly sensitive to drying, which necessitates the selection of emaciated additives.

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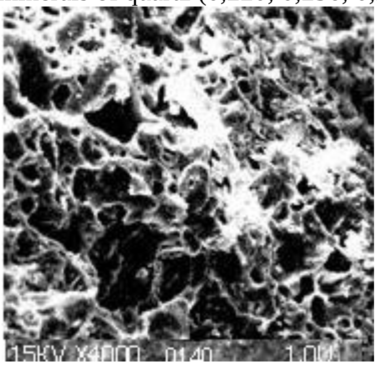
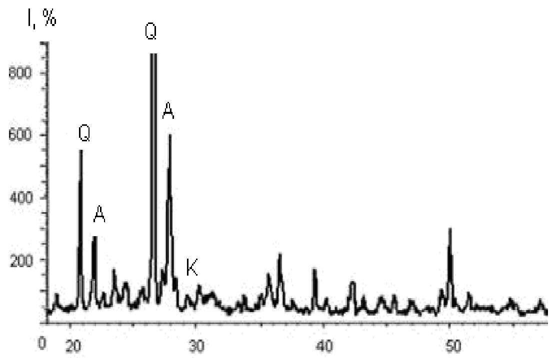
From an economic point of view, brick slag is recommended as an anchor, which is formed when conventional karmic bricks are fired, the volume of which reaches 10-15% of the output. According to the studied data, dark brown ceramic slag is formed as a result of the melting of the low- melting part of the raw material and cools down in the form of a stone density of 2100-2700 kg/m^3, mechanical strength of 20 - 30 MPa. Until now, slag of ceramic bricks is not used and is stored in factories. In the experiments, the crushed slag fraction of 0,5-1 mm was used. The chemical composition of the ceramic brick slag is turned off the following components percentage SiO_2 -60,75; Al_2O_3-13,35; TiO_2-0,49; Fe_2O_3 – 6,08; CaO-12,97; MgO-3,24; Na_2O-1,02; K_2O-2,04.

Electron microscopic studies of slag shown in Fig. 2 (a) show that the mass is represented as a loose material with abundant closed pores consisting of glass the abundance of pores indicates the incompleteness of the degassing stage similar to those in the processes of glass melting.

X-ray phase analysis of a sample of ceramic brick slag is presented in Fig. 2 (b), testifies that it contains minerals of quartz (0,220; 0,256; 0,211 nm) anorthite (0,230; 0,285; 0,251 nm), cristoblite (0,295; 0,380; 0,500 nm)



a)



b)

Fig 2. Electron microscopic (a) and X-ray phase (b) images of ceramic brick slag.

According to the data obtained by IR spectroscopic studies in the wavelength range of 400-1500 sm, there are stretching vibrations characteristic of the group. As it is known from literary sources [6], the reduced plasticity of loam (due to the prevalence of non-clay impurities in the material composition) causes a small connectivity of clay masses, Especially with plastic molding method,,low after firing,whch determines the need for platicization of such maseses.

To this end, it was proposed in the work to process a part of the raw material with a slip method, followed by fractional separation of the plastic part, as well as with the use of mechanical activation, to improve its binding properties. In the part devoted to the study of binder isolated from the raw materials, data are presented on the method of isolating the binder-liquefaction of loess loam with subsequent gravitational separation, using mechanical activation of the selected plastic part in order to improve its binding properties.

Table 3.The average chemical composition of the binder, isolated from the loess-like loam of the Yarmyshskoye field (mass.prosents)

SiO_2	Fe_2O_3	TiO_2	Al_2O_3	CaO	MgO	K_2O	Na_2O	p.p.p
50,01	4,22	0,39	19,05	11,38	2,75	1,06	0,65	10,49

With equal data you will cast in the table. 1 and table. 3 show increase in the content of Al_2O_3 in the mass due to processing, and the content of other oxides decreases, in comparison with the feedstock also found that the content of mineral salts in the composition of the binder is sharply reduced. X-ray phase studies (Fig. 3) show the presence of hydromica (0,180; 0,190; 0,207; 0,226; 0,286 nm), montmorillonite (0,422; 0,253; 0,697 nm), kaolinite (0,283; 0,420; 0,366 nm), quartz (0,300; 0,336; 0,316 nm), calcite (0,973; 0,692; 0,185 nm).

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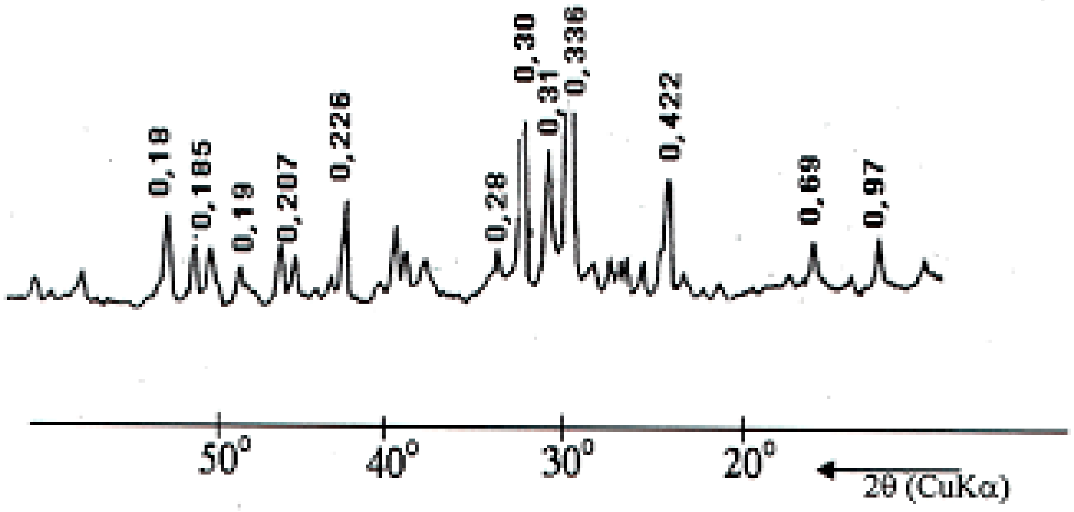


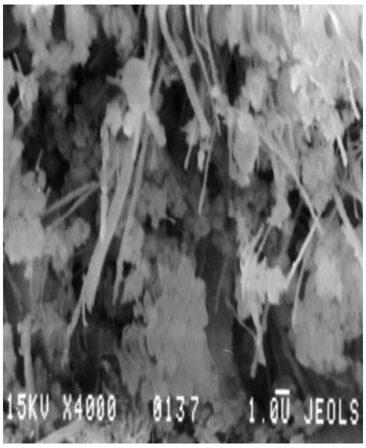
Fig 3. X-ray phase analysis of mechanically activated binder based on loess loam.

Differential thermal analysis of its binder shows that a number of exo and endothermic effects are observed during heat treatment. In particular, at 100 °C an endothermic effect appears associated with the release of hygroscopic moisture. At 350 °C, the exothermic effect associated with the burning of organic impurities. The endothermic effect present on the thermo gram at 570 °C corresponds to the release of water of crystallization. Endothermic effects associated with, decarburizations of carbonate inclusions are observed at 880-900 °C. In the temperature range of 320-940 °C, an exothermic effect is observed associated with the crystallization of amorphous inclusions. The studied technological properties of binding samples are presented in table, four.

Table 4.Technological properties of a binder isolated from loess loam

Atter beig plasticity number	Aerial whisker age	Coifficity of sensitivity to drying	Mechanical strength	Bulk weight kg/m^3
18,95	4,50	180	3,07	1675

a)



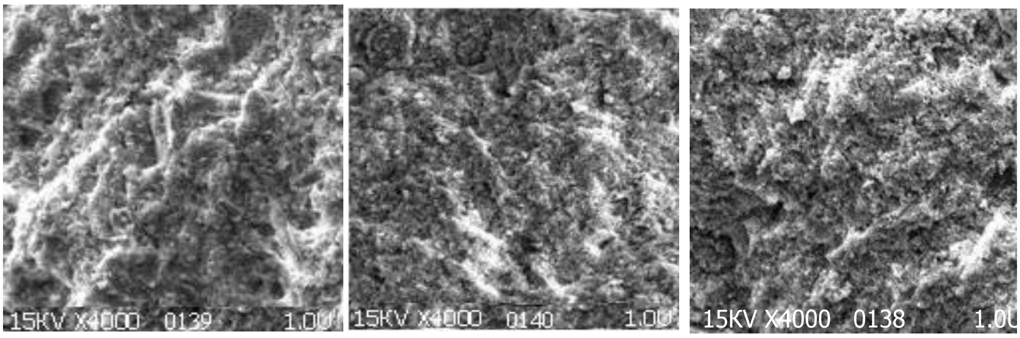
b)

Fig 4. Electron microscopic image of the loess (a) and mechanically activated binder (b) based on it

The number of input components of the brick mass varied in the following limits (mass.%): Loess-like loam-70÷100; brick slag-5÷30; binder- 5÷30; coke breeze -1÷5. Sample preparation was carried out according to the generally accepted ceramic technology. The dependences of changes in the physic mechanical properties on temperature, on exposure time, and on the roasting medium were studied. The firing temperature was 900, 950, 1000 ^{o}C. Isothermal exposure of 6-10 hours in various conditions of roasting.

V. EXPERIMENTAL RESULTS

The methods of physical and chemical studies studied the basic operational properties of prototypes. The results ol which are given in table, five. From the data obtained it can be seen that the indicators of sample compositions K1-5, K4-5, K7-5 meet the requirements of interstate standards and European standards. Electron microscopic examination of the texture of the samples obtained (Fig. 5) shows that they are all dense



a) b) c)

Fig 5. Electron microscopic photographs of samples annealed at temperatures of 950 °C. a) K1-5 composition b) K4-5 composition c) K7-5 composition

Electron microscopic images show that the texture of the samples is mainly represented by dense intergroup crystalline bodies. Comparative studies of samples show that samples of the composition K4-5 have the most dense structure, hey X-ray photographs of the obtained samples, calcined at a temperature of 950 ^{o}C, indicate the presence in the sample of crystalline phases of anorthite (0.318; 0.251; 0.403 nm), cristabolite (0.334; 0.253; 0.338; 0,415nm) of dipids (0.271; 0.299; 0.362 nm).

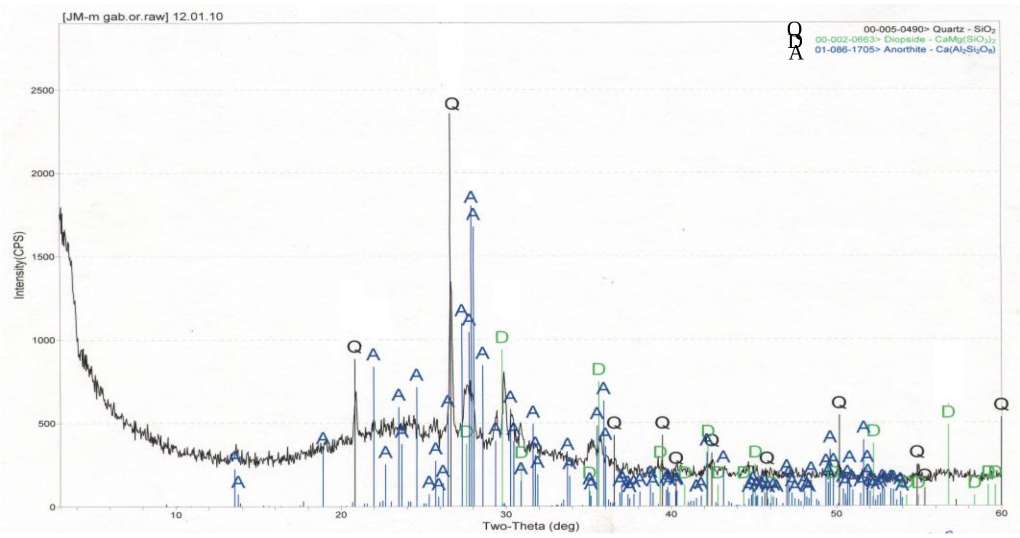


Fig 6. X-ray phase images, of the obtained samples, annealed at a temperature of 950°C

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VI. CONCLUSION

Thus, the result of laboratory tests shows the possibility of obtaining waterproofing salt-resistant ceramic bricks from the basis of low grade loess loams and waste industry.

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