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The Influence of the Choice of Raw Materials on the Strength Characteristics in the Production of Ceramic Bricks in the Fergana Region

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ABSTRACT

This article examines the effect of raw materials on ceramic bricks, as well as how raw materials change depending on storage conditions and storage duration. As you know, the quality of the finished product directly depends on the raw materials. A chemical analysis of raw materials of ceramic bricks was carried out in different fields of the Fergana region.

KEYWORDS: Rishtan, Avval, Baghdad, Dangara, Kuva, Ceramic bricks and stones, length, width and thickness of bricks, bending, laboratory, geometric dimensions.

INTRODUCTION

Physical and mechanical tests were carried out in an accredited laboratory for compliance with UzSS 3255: 2017 "Ceramic bricks and stones". According to the standard, the geometric dimensions, appearance, average density, average density class, water absorption, bending strength and compressive strength were determined.

At the moment, in the production of ceramic building bricks, attention is focused on improving technology, improving the quality of products and expanding the range. During the construction of new enterprises, it is planned to install automated and highly mechanized technological lines on the basis of modern domestic and imported equipment.

THE MAIN FINDINGS AND RESULTS

Ceramic technology, which provides for the manufacture of clay products by molding and firing, has recently become widespread in the production of ceramics from other non-clay mineral raw materials - from pure oxides.

In modern conditions, the production of building materials is one of the most important areas of our domestic industry. This is due to the annually increasing pace of construction and a shortage of high quality building materials. Disadvantages, low quality and high cost of many building materials, make us look for more perfect and innovative methods of their production and more affordable raw materials.

For the study, several brick factories were selected located in different five districts of the Fergana region (Rishtan, Avval, Baghdad, Dangara, Kuva). All brick factories have large enough warehouses to store raw materials for up to three years.

To compare the effect of clay aging on the strength characteristics, the following factories Rishtan, Avval, Baghdad, Dangara, Kuva were selected. Since each plant, due to the circumstances of demand, uses clays with different aging (storage) periods, it was decided to mark them with indices corresponding to the amount of raw materials stored in the warehouse.

Since there is a standard where the standard for test methods is specified, the need for automatic validation is not required. All tests were carried out in accordance with UzSS 3255: 2017, Interstate Standard 8462-85, and Interstate Standard 7025-91.

As a result of drying and firing, ceramic bricks inevitably undergo air and fire shrinkage, which does not allow obtaining bricks of strictly specified geometric dimensions. Therefore, the UzSS 3255: 2017 standard provides for permissible deviations in the length, width and thickness of bricks, and also regulates the presence of chipped corners, curvature of edges and edges, and the presence of cracks.

According to Interstate Standard 7025-91, the average density ρ_{cp} of ceramic bricks is determined by the formula:

$$\rho_{cp} = \frac{m}{V}$$

Where m – sample weight, kg
V- sample volume, см^3

The density of a brick determines its main operational properties. The higher the density, the higher its

strength, frost resistance, thermal conductivity, and less water absorption.

According to the normative document, the brand of ceramic bricks is characterized by the ultimate strength in compression and bending by testing samples selected according to the appearance indicators of 10 pieces for compression testing and 5 pieces for bending.

The obtained results are as follows:

1) Geometrical dimensions and appearance

№ p/p	Indicator name	ND requirements	Actual indicator							Note
			Rishtan-1	Avval-2	Baghdad-1	Dangara-2	Rishtan-2	Kuva-1	Kuva-3	
	Length, mm	250±7	250	251	249	250	250	248	247	
	Width, mm	120±5	120	121	119	120	120	116	115	
	Thickness, mm	65±3	65	66	64	65	65	62	62	
	Chipped corners with a depth of more than 15mm, pcs	4	0	0	2	1	0	3	3	
	Chipped edges and edges longer than 15 mm, pcs	4	1	1	3	2	1	3	3	
	Cracks no more than 30 mm long on the bed, pcs	4	0	0	0	0	0	0	0	
	Undercut	not regulated	Not available	Not available	Not available	Not available	Not available	Not available	Not available	
	Lime inclusions, causing after steaming of products, destruction of surfaces and spalling with a depth of more than 6mm,	Not allowed	Not available	Not available	Not available	Not available	Not available	Not available	Not available	

2) Class of medium density of the product

№ p/p	Indicator name	ND requirements	Actual indicator							Note
			Rishtan-1	Avval-2	Baghdad-1	Dangara-2	Rishtan-2	Kuva-1	Kuva-3	
	Medium density class	-	2,0	2,0	2,0	2,0	2,0	2,0	2,0	

3) Compressive and flexural strengths

№ p/p	Indicator name	ND requirements	Actual indicator							Note
			Rishtan-1	Avval-2	Baghdad-1	Dangara-2	Rishtan-2	Kuva-1	Kuva-3	
	Average tensile strength in bending, not less MPa	1,8	2,0	1,9	1,8	1,9	2,0	1,8	2,0	
	The smallest bending strength, not less MPa	0,9	1,2	1,2	1,1	1,1	1,4	0,9	1,1	
	Average compressive strength, not less MPa	7,5	8,8	8,8	7,6	7,7	9,2	7,5	8,5	
	The smallest compressive strength, not less MPa	5,0	7,7	7,0	5,7	5,9	7,9	5,1	6,7	

As can be seen from the test results under the same storage conditions for raw materials and manufacturing technology, the geometric dimensions do not change. The class of average density also does not change; however, there is a change in strength characteristics, and in a positive direction.

In the Kuva region, raw materials for the production of ceramic bricks do not meet the standard. In this connection, brick factories have to bring raw materials from quarries of another region with the best clay characteristics, then mixing to obtain the optimal composition of the charge. Some factories store raw materials in open warehouses, possibly in order for precipitation to dissolve the salts contained in the clay.

For other regions, such as Rishtan, there is no need to improve the composition, but there is not a rational consumption of high-quality raw materials and more increased energy costs.

CONCLUSION

Based on the test results, it follows that between the raw materials used directly from the quarry, and the raw materials kept in storage for a year or two, there is an influence on the strength characteristics.

In the future, it is necessary to fully study the chemical composition of the raw material, and the possibility of optimizing the charge regardless of the raw material deposit.

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