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Founder - Tashkent State Transport University
100167, Republic of Uzbekistan, Tashkent, Temirulchilar st., 1.
Tel.: +998 71 299 01 89 E-mail: nauka@tstu.uz

CONTENTS

DETERMINATION OF INDUSTRIAL WASTE-BASED PROPERTIES OF STRUCTURAL HEAT PROTECTION AERATED CONCRETE BETON

Shaumarov Said Sanatovich,
Kandakharov Sanjar Ishratovich,
Okilov Zafarjon Omon ogli
Sultonkhodjayeva Gulnoza
Tashkent state transport university, Tashkent, Uzbekistan

Abstract: *This article presents the results of experimental studies that describe the parameters and properties of the porous structure of aerated concrete based on industrial waste. The structurally optimal parameters reflecting the physical, mechanical, and thermal properties of the foam concrete exterior wall structures have been determined. The test results were carried out in research laboratories using gas-block structures with high porosity and optimal composition, and an improved technology of autoclave aerated concrete was proposed.*

Key words: *Aerated concrete beton, strength, porosity, thermal protection, water-cement ratio.*

INTRODUCTION

In the Republic of Uzbekistan, special attention is paid to the introduction of new technologies for the construction of energy-efficient buildings, the localization of the modern construction materials industry and the gradual abandonment of imported products, the reduction of the cost of construction products, and the reduction of energy consumption in the operation of buildings and structures [1-3].

In this direction, the President of the Republic of Uzbekistan Sh.M. Under the leadership of Mirziyoyev, the major reforms in the construction industry were implemented. This is aimed at ensuring a high rate of production and export of competitive products from local raw materials in the Republic of Uzbekistan, as well as modernization of enterprises, processing of industrial waste products, technical and technological structural changes in the building materials industry [4-6].

An important trend in the development of the aerated concrete market is to improve the quality of non-autoclaved concrete products. For this, it is necessary to use all available technological methods in the organization of production, which allow the production of high-quality products with high maturity and high durability. At the molding stage and during heat and moisture processing, attention should be paid to improving the structure of foam concrete, which is carried out with controlled parameters of the temperature and humidity of the heating medium, which leads to a decrease in the residual moisture of the concrete and subsequent shrinkage. A complex approach to the development of technology for the production of aerated concrete without autoclave allows to bring the physical and mechanical properties of this type of material closer to autoclaved concrete.

A.I.Adilkhodzhaev, E.V.Shchipacheva, X.A.Akramov, S.A.Khodzhaev, R.R. Kadyrov, S.T. Suleymanov, I.K. Kasimov, U. .A. Gaziev, M.A. Sagatov, S.S. Shaumarov and other scientists are working on the development of the optimal composition of filler mixtures based on industrial waste.

In these studies, various properties of aerated concrete, strength, heat protection, optimization of porosity, and reduction of humidity were conducted with the help of mineral and organic additives, plasticizers.

Incorporation of industrial waste into aerated concrete protects it from harmful substances for nature and significantly reduces the price of the product.

When performing laboratory research work, it is necessary to ensure the same volume change during the hardening of binders, including cements [8-10]. During the hardening process, different volume changes lead not only to a decrease in strength, but also to different volumes of porosity.

RESEARCH METHODS AND TOOLS

The thermal and technical characteristics of aerated concrete blocks were carried out using the theoretical methods established in accordance with the regulatory requirements of KMK 2.01.04-18 "Construction thermal engineering", and calculations were performed using the following formula:

$$P_0=n(t_v-t_n)/\Delta t_n\alpha_v$$

n - the coefficient depending on the position of the outer surface of the barrier structures relative to the air, t_v - the temperature of the room, t_n - the external temperature of the air, Δt_n - the temperature of the inner surface of the barrier structure, α_v - the temperature coefficient of the inner surface of the barrier structure.

The actual thermal conductivity of aerated concrete blocks is determined as follows:

$$P_0=1/\lambda_n+\delta/\lambda+1/\lambda_v$$

λ_n, λ_v - the coefficient of heat transfer of the external and internal surfaces of the barrier structure, d - the size of the width of the structure, l - the heat transfer coefficient of the barrier structure.

Frost resistance of aerated concrete blocks was carried out by GOST 31359-2007 "Methodology for determining frost resistance of aerated concrete".

Experimental studies were carried out using filling materials based on industrial waste, laboratory tests using non-standard methods developed by scientific research experts according to generally accepted standards.

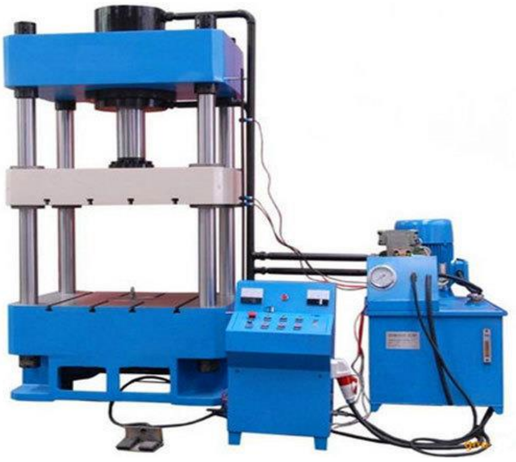

FIGURE 1. *Hydraulic press*

Determining the optimal porosity composition of the specified structural heat-shielding aerated concrete was performed using automated computer software [6-8].

Determination of the strength of aerated concrete samples using a hydraulic press was carried out in the following sequence:

1. 100x100x100 mm cubes of aerated concrete samples were installed in the press in turn.

2. The samples were gradually compressed with a continuously increasing force and lost their cubic shape.

3. Maximum breaking strength values for each sample were recorded.

4. The average breaking strength of several samples was analyzed and its brand was determined.

IMPROVING THE OPTIMAL COMPOSITION OF POROUS EXTERNAL WALL CONSTRUCTIONS BASED ON INDUSTRIAL WASTE

D600 grade aerated concrete blocks, industrial waste sand and industrial waste slag filler and binding materials were selected for laboratory research. The prepared aerated concrete blocks consist of samples with dimensions of 100x100x100 mm.

Two different compositions were prepared for the experiment: the first composition used waste quartz sand as gas block filler, and the second composition was carried out using waste slag. In the first composition, cubic samples with dimensions of 100X100X100 mm were prepared from mixtures with 5, 10, 15, 20% waste sand in relation to the mass of sand, and these compositions are presented in Table 1 [7-8].

TABLE 1.

Composition of 1 m^3 aerated concrete based on industrial waste sand

W/C	Spread of the mixture in Suttard, cm	Industrial waste sand	Average density, kg/m^3	Moisture, %	Strength, MPa	Thermal conductivity
0,44	15	5	645	30	1,64	0,15
	20	10	652	31	1,657	0,14
	25	15	658	32	1,67	0,145
	30	20	660	33	1,665	0,15

The samples were tested for compressive strength using a hydraulic press. According to the results of the research, samples with the best characteristics were identified. The results of this experimental study are presented in Figure 2.

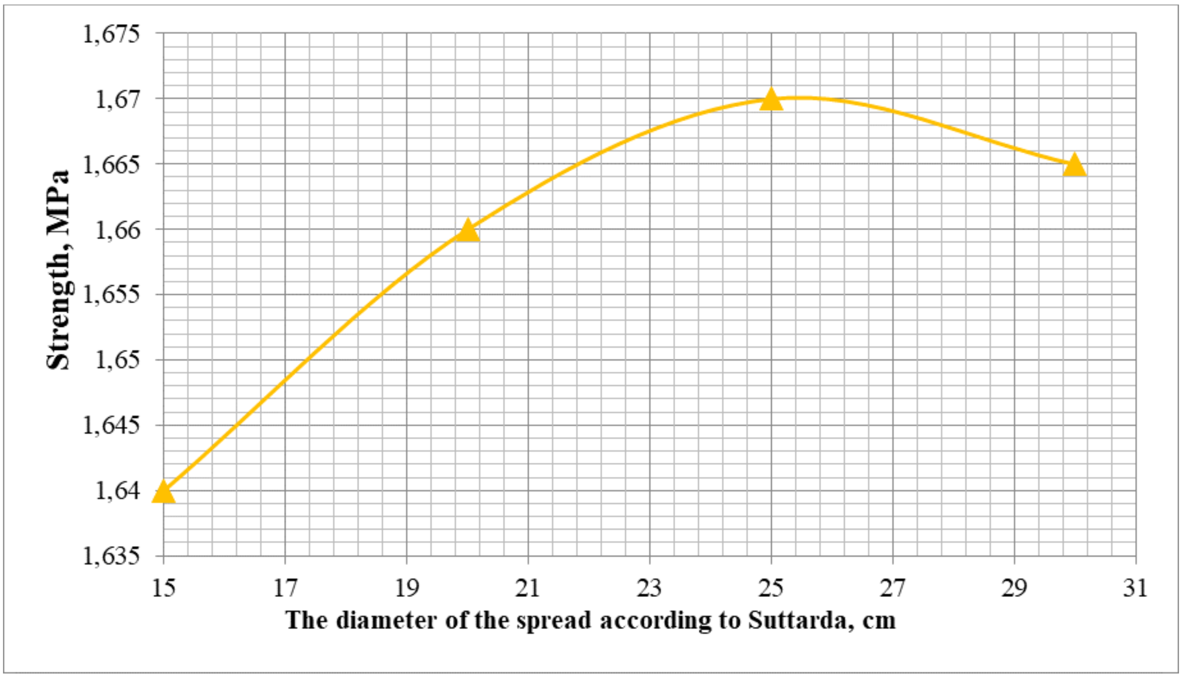

FIGURE 2. *Dependence of the consistency of the mixture density*

In the graph above, you can see the effect of aerated concrete material on the stability of the spreading diameter in the "Suttarda Viscometer" experimental device.

It can be seen from the graph that if waste sand is used as an industrial waste product without changing the ts/s ratio, its strength reaches its optimal strength depending on the diameter of the spread.

In the second composition, waste slag was added in the amount of 8, 10, 12, 14% relative to the mass of cement, and cube samples with dimensions of 100X100X100 mm were prepared. The samples were kept at a constant temperature for 28 days to solidify uniformly. The compositions of the mixtures are presented.

Also in this case, the limit of compressive strength of the samples was determined using a hydraulic press. The most optimal values of these results were selected. The effect of waste slag on gasblock samples and their relative classification are presented in Figure 3.

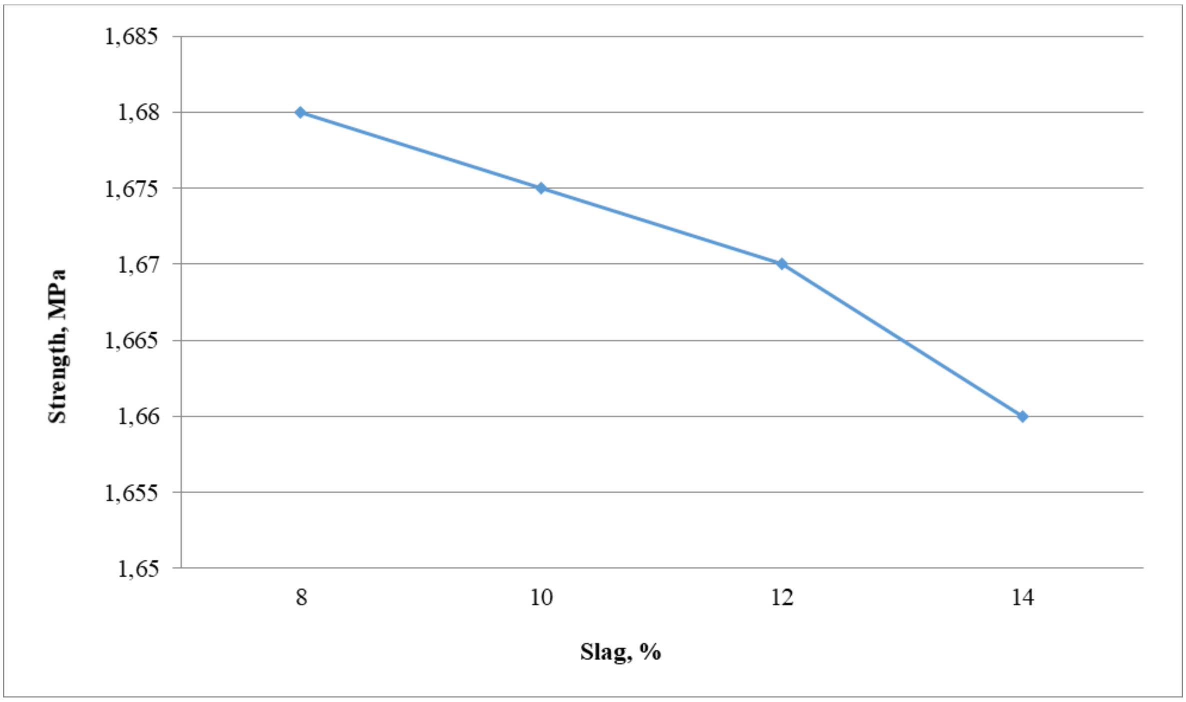

FIGURE 3. *Classification of aerated concrete depending on waste slag*

This graph shows that when waste slag is added to aerated concrete, if its binding property exceeds 12%, the strength will be significantly reduced. So, it can be seen that if waste slag is added to aerated concrete in the amount of up to 12%, its strength index meets the requirements.

The analysis of research laboratories shows that when waste sand and waste slag are added to the composition of non-autoclaved aerated concrete samples, their strength characteristics fully satisfy the requirements of the state standard GOST 10180-2012, and its cost is reduced by 10-11%.

CONCLUSION

1. The laboratory results of the research carried out in production organizations showed that when the same solidification process was ensured when its humidity was less than 5%, there was an improvement of 1-3% in dangerous cracks and 2.1-4.3% in porosity of non-autoclaved gas blocks.
2. It allows to reduce the fillers of the recommended gas blocks by 10-15% due to waste sand.
3. The results of the conducted experimental research laboratories showed that when the gas block is made using waste sand and waste slag, its binding amount allows to save 8-12%. price
4. In the process of production of porous concrete blocks, the inclusion of the above-mentioned and other types of industrial waste in the concrete composition, first of all, creates the possibility of processing (utilization) of waste, saving binder (cement), increasing the operational properties of the manufactured structure.

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