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Energy Efficient Lightweight Guarding Structures

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ABSTRACT

The article presents data from studies of porous claydite concrete with TPP ash and polymeric polyfunctional additive K-9. The concrete is intended for the production of building envelopes. An increase of 12% in the initial modulus of elasticity, an increase in physical and mechanical properties, a decrease in the coefficient of thermal conductivity of porous claydite-ash concrete by 8.1% are shown, which indicates an increase in the heat-shielding properties of enclosing structures, an increase in their energy efficiency.

KEYWORDS

Sustainable development strategy, "green" construction, lightweight concrete, deficit of expanded clay sand, porous binder, porous concrete mixture, complex gas generator, TPP ash, polymer additive, porous expanded clay ash concrete, water absorption of concrete, porosity, heat-shielding properties of enclosing structures.

INTRODUCTION

As you know, the concept of energy efficiency is closely related to the issues of energy conservation. Sustainable development strategy, new technologies contributed to the organization of "green" construction, energy efficiency of buildings. "Green" construction in the republic as a practice of construction and maintenance of buildings, the purpose of which is to reduce the consumption of energy and material resources throughout the entire life cycle of a building: from site selection to design, construction, operation, repair and disposal is gaining momentum.

The less a building loses heat, the less energy needs to be supplied to replenish heat losses. The simplest and most rational way to save energy for heating is to improve the heat-shielding properties of building envelopes.

In seismically active regions of Uzbekistan, in the production of external enclosing structures of buildings, as is known, it is necessary to use lightweight concrete, which must have a solid structure, which, at high heat-shielding performance, provides sufficient protection from atmospheric moisture, and reinforcement from corrosion.

Heat loss through lightweight concrete walls according to [1] is up to 30%. The problem of increasing the thermal properties of lightweight concrete of external walls is combined with the problem of creating lightweight concrete.

Lightweight concretes based on porous aggregates have fundamental differences from ordinary heavy concrete, which are due to the characteristics of porous aggregates. The latter have a lower density than dense ones, much less strength, have a highly developed and rough surface.

A decrease in the average density of concrete is achieved by careful selection of the grain size distribution of the aggregate, as well as the minimum consumption of a binder for concrete with a given strength, that is, the maximum filling of the concrete volume with a porous aggregate.

According to [2], the main type of aggregate in lightweight concrete in the republic for the near future will remain expanded clay gravel, the bulk density of which significantly exceeds the standard requirements and does not allow obtaining structural and heat-insulating concrete of the required average density.

The reason lies in the low quality of most clays, non-compliance with technological regulations and other factors.

Thus, the bulk density of expanded clay gravel at the enterprises of the republic is 600 ... 700 kg / m3, which makes it possible to obtain according to the usual technology expanded clay concrete with an average density of 1200 kg / m3 and more of class B5 instead of 1100 kg / m3 according to regulatory requirements.

In addition, the grain composition of the aggregates has a significant effect on the properties of lightweight concrete - average density, thermal conductivity, and cement consumption [2].

At the same time, for structural and heat-insulating concretes, the maximum size of gravel and crushed stone is recommended - 20 mm; the minimum grain size is 5 mm. A mixture of fractions - 5-10 mm is recognized as optimal. However, the question of the most optimal ratio in this mixture of fractions of 5-10 mm and 10-20 mm remains problematic.

It is possible to obtain lightweight concrete with scarce expanded clay produced in the republic by creating an optimally porous structure of intergranular space, in other words, by porous binder.

At the same time, porous expanded clay concrete makes it possible to make up for the lack of scarce expanded clay sand, reduce the density and thermal conductivity of concrete, reduce the water demand and release moisture content of products, improve the cohesion and workability of the mixture and achieve a number of other advantages [1-10]. Porous claydite concrete with cement consumption equivalent to ordinary expanded clay concrete has practically equal strength.

Porous concrete mix is less susceptible to water separation, since air bubbles seem to clog the channels through which water circulates. In this case, the intergranular space of expanded clay is filled with porous cement paste, consisting of small closed pores [3-8].

Various types of lightweight concrete for external walls have been developed (expanded clay concrete; expanded clay concrete modified with a chemical additive; expanded clay aggregate; porous expanded clay concrete).

Effective porous expanded clay concrete allows not only to make up for the lack of scarce expanded clay sand, but also to reduce the density and thermal conductivity of concrete, reduce the water demand and release moisture content of products, improve the cohesion and workability of the mixture and achieve a number of other advantages.

When creating an optimally porous structure of the intergranular space, we proceeded from the condition of the distribution of macroporosity and microporosity in a ratio of 5: 3 with a content of pores with an average radius of up to 20% of the total porosity.

Achievement of this requirement became possible due to the use of a complex blowing agent based on PAK-3 (PAK-4) aluminum powder and K-9 chemical additive (water-soluble polyfunctional acrylate additive - waste from the production of nitron fiber and acrylonitrile).

The K-9 additive, like all additives - wetting agents of an ionic nature, envelops the particles of aluminum powder, evenly distributes them in the volume of the binder, prepares them for a joint spontaneous reaction.

The resulting unique complex blowing agent provides a decrease in the average density while maintaining the required strength at the lowest consumption of aluminum powder.

Replacing a part of expanded clay sand in expanded clay with ash (50% of the volume and complete 100% replacement), which has an amorphous structure and a bulk density lower than the bulk density of expanded clay sand leads to a decrease in thermal conductivity.

At the same time, it was found that the presence of ash in the composition of expanded clay concrete leads to a change in the moisture characteristics of concrete. So, the coefficient of moisture conductivity increases by about 70%, which indicates a more intensive penetration of moisture into the depth of concrete [4-10]. This has an unfavorable effect on the moisture and heat engineering conditions of the outer walls.

The elimination of the above negative phenomena is ensured by the polyfunctional - hydrophobic-plasticizing effect of the K-9 additive, which modifies the porosity of concrete, hydrophobizes its pores and capillaries.

As a result of the introduction of a polymer additive of acrylate action, the sorption moisture content of expanded clay concrete, expanded clay aggregate and porous expanded clay decreases by 8-10%, the coefficient of moisture conductivity of expanded clay decreases by 45%, expanded clay - by 30%, porous expanded clay - 29-30%.

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The study of the physical and mechanical characteristics of the developed porous claydite-ash concrete of the optimal structure showed an increase of 12% in the initial modulus of elasticity. Concrete of class B 7.5 of optimal structure has withstood more than 200 cycles of alternate freeze-thaw cycles.

Water absorption of concrete, depending on the porosity of porous claydite-ash concrete, has a great influence on the heat-shielding properties of the enclosing structure and its durability.

During the experiments, it was noted that the most intense process of water absorption was noted for the first seven days, in the following days, water absorption slows down. The test results are shown in Table 1.

Table 1 - Water absorption of porous kerazitozol concrete

Composition number *	Concrete class	Compressive strength, MPa	Average density of concrete, kg / m^3	Water absorption by weight,%	Water absorption by volume,%
1	B5	8,1	1040	15,34	16,2
2	B7,5	10,8	1080	16,7	17,7
3	B7,5	9,8	1060	17,8	18,5
4	B7,5	10,2	1090	18,4	19,4

*** 1, 2 - concretes of optimal composition, 3, 4 - concretes of non-optimal composition.**

The thermal conductivity of porous claydite-ash concrete is determined by its density, qualitative and quantitative composition of aggregates and binder, and the degree of porosity of the binder.

Experimentally, using a Bocca device, the thermal conductivity was determined as a function of humidity by the method of stationary thermal conditions. The combined use of ash, a polyfunctional additive K-9 and a complex gas-forming additive reduces the coefficient of thermal conductivity of porous concrete by 8.1% [4].

The thermal conductivity of concrete (class B5, B7.5) with an average density of 900-1100 kg / m3 is in the range of 0.2-0.35 W / m oC.

CONCLUSIONS

Thus, energy saving in buildings from the standpoint of "green" construction can thus be ensured by using the technology of developing energy-efficient porous claydite-ash concrete with sufficient thermal characteristics for building envelopes.

REFERENCES

1. Beregovoy A.M. Heat storage properties of materials and structures of fences in the process of forming the thermal regime of premises. Izv.universities. Construction - 2002 №7 - p.4-6.

2. Makhkamova M.Z. Development of compositions and study of the physical and mechanical properties of sandless expanded clay concrete for the manufacture of external wall panels in the conditions of the Central Asian region. Technical report, M., 1986.
3. Komissarenko BS, Chiknovor'yan AG .. Effective single-layer external wall panels made of sandless expanded clay foam concrete on a new synthetic foaming agent / "Building materials" magazine. 2000, no. 6.
4. Abdukhalimjohnovna M. U. Failure Mechanism Of Bending Reinforced Concrete Elements Under The Action Of Transverse Forces //The American Journal of Applied sciences. – 2020. – Т. 2. – №. 12. – С. 36-43.
5. Y.M. Mahkamov - The American Journal of Engineering and Technology, 2020 Design Model Of Bending Reinforced Concrete Elements Under Action Of Transverse Forces Under Conditions Of Increased And High Temperatures.
6. Rybiev I.A., Goncharova N.I. Porous expanded clay concrete as a type of artificial building conglomerates. // Effective materials for housing construction, Collection of articles NITSM, Moscow, 1990, 35 p.
7. Goncharova N. I., Abobakirova Z. A., Kimsanov Z. Technological Features of Magnetic Activation of Cement Paste" Advanced Research in Science //Engineering and Technology. – 2019. – Т. 6. – №. 5.
8. Кимсанов З. О., Гончарова Н. И., Абобакирова З. А. Изучение технологических факторов магнитной активации цементного теста //Молодой ученый. – 2019. – №. 23. – С. 105-106.
9. Muratovich D. S., Shavkatovich N. K. Influence Of Changes In Microclimate Parameters On Human Well-Being And Operational Characteristics Of Building Structures //The American Journal of Engineering and Technology. – 2020. – Т. 2. – №. 11. – С. 113-117.
10. Davlyatov S. M., Makhsudov B. A. Technologies for producing high-strength gypsum from gypsum-containing wastes of sulfur production-flotation tailings //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 10. – С. 724-728.