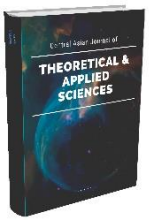

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Influence of the Ratio of Cement and Aggregate on the Properties of Foamed Concrete

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Abstract: *The article describes the results of experimental studies to identify the effect of the content of cement and aggregate on the properties of foam concrete. It was found that the physical and technical properties of foam concrete are significantly influenced by the content of sand with a natural grain composition. It was revealed that with an increase in the amount of sand in the composition of the mixture, the bulk density of the foam concrete increases, and the strength of the foam concrete decreases. The results obtained and the conclusions arising from them are of great importance in the processing of technological modes for the production of foam concrete and in the design of foam concrete structures with specified physical and technical properties.*

KeyWords: *foam concrete, aggregate, grain size composition, sand, cement, average density, strength, solid phase, porosity, foaming agent.*

Introduction

The construction industry now offers many effective thermal insulation materials and thermal protection technologies for buildings. Analysis of literary sources [1-6] shows that the main heat-insulating materials that are distinguished today by their main properties and are widely used are mineral wool products, gas-filled plastics (foam plastics), foamed mineral thermal insulation materials (foam concrete, foam glass). Of all the insulating materials listed above, aerated concrete stands out in terms of environmental friendliness and technical performance [7,8].

Such materials include foam concrete, aerated concrete and foam aerated concrete that harden in an autoclave and under normal conditions. The growth of low-rise construction in Uzbekistan in recent years requires the expansion of the production of small-sized wall construction materials made of foam concrete. This is explained by its high technical and economic properties and a wide raw material base. The advantages of foam concrete are the size of the wall blocks made of foam concrete, the speed and quality of beating the walls, ease of processing, environmental safety, high heat and soundproofing properties compared to traditional brick.

Materials and methods

The main components in the production of foam concrete are cement and aggregates. The practice has shown that the properties of removable foam concrete vary significantly depending on the composition and type of components used. An increase in the amount of filler also leads to an increase in the strength and average density of the foam concrete. In addition, when heavy coarse-grained aggregates are used, the foam concrete mix collapses. Therefore, in the preparation of foam concrete are used fillers with a size smaller than 2.5 mm - mainly sand, ash and crushed industrial waste. The analysis of the literature on foam concrete does not sufficiently cover the effect of the size of the aggregate particles used in its preparation on the properties of the product to be obtained. Therefore, studies have been conducted to determine the effect of filler particle size on the properties of foam concrete. This article describes the results of the study. The research used sand from the Fergana region, Yazyavan district and Portland cement PTs400 D20 of JSC "Kuva-cement" (Uzbekistan). PB-2000 foaming agent was used as a foaming agent. The studies were conducted in the following order. Initially, a separate technical foam was prepared. The amount of foaming agent was 0.5% of the water. The foam was prepared for 3 minutes, then the foam was cemented and 0.63; 0.31; 0.14 and 0.14 sieved sand was added. Mixing the foam concrete mix took 2 minutes. The mixture was then poured into metal moulds measuring 10x10x10 cm, the hardening of foam concrete samples was carried out under natural conditions. The properties of the samples obtained were determined after 7, 14 and 28 days. In the experiments, the water-to-solid ratio (W/S) was taken to be 0.5. The proportion of solid components includes cement and filler mass. The amount of foaming agent was 0.5% of the water. Table 1 shows the physical and mechanical properties of foam concrete obtained on the basis of sand of different sizes. In the preparation of the mixture, the ratio of cement and filler was 0.5, the concentration of the aqueous solution of the foaming agent was 0.5%.

Table 1. Influence of sand size on physical and mechanical properties of foam concrete

№	Filler type and size	Average density, kg / m^3	Compressive strength limit, MPa		
			Duration of hardening, days		
			7	14	28
Sand					
1	Smaller than 1,25 mm	760	0,9	1,2	1,4
2	Smaller than 0,63 mm	710	0,7	1,0	1,2
3	Smaller than 0,31 mm	640	0,6	0,85	1,05
4	Smaller than 0,14 mm	550	0,5	0,7	0,8

From the results of the research, it was found that in the production of foam concrete, it is preferable that the solid components are crushed or use fine-grained materials. The smaller the size of the filler particle, the greater the porosity of the material and the smaller the porosity. When using sand through a sieve with a mesh size of 1,25 mm, the average density of the obtained foam concrete was 760 kg/m^3, while when using sand through a sieve 0,63 , the average density decreased to 710 kg/m^3. From the information presented, it can be seen that when sand through a sieve 0,14 mm is used, the density of foam concrete decreases to 550 kg/m^3.

Conclusion

Thus, the dimensions of the aggregate used to have a great influence on the physical and mechanical properties of the foam concrete. When large-sized aggregates are used, the average density of the foam concrete increases and the strength decreases. The obtained results and conclusions are of great importance in optimizing the technological modes of production of foam concrete and in the design of foam concrete structures with defined physical and technical properties.

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