УДК 666.5.76

SELECTION OF THE OPTIMAL COMPOSITION OF FIBER CONCRETE BASED ON BASALT FIBERS AND ANALYSIS OF PHYSICAL MECHANICAL PROPERTIES

https://doi.org/10.5281/zenodo.7063691

Ametov Rasul Nazirboyevich, *assistant*

Jizzakh Polytechnic Institute,

urokboyevollayora@gmail.com

Abstract: At present, the demand for cheap materials and products from the energy-efficient economic side in the world construction sector is increasing. In this case, building materials made from local raw materials and industrial waste, first of all, save energy in the process of preparation, and secondly, due to the use of local waste, its cost also partially decreases [1]. At the same time, the use of secondary resources in order to rationally use the depleted resources is currently a topical issue.

Key words: Cement, concrete, aggregate, basalt fiber, microsilica, strength, composite material.

The production of composite materials based on basalt fiber helps to solve the following urgent tasks:

- saves the main raw material base of construction materials production, that is, resources and eliminates the lack of natural raw material reserves;

- local seondary resources are used instead of imported raw materials;

- solves issues of environmental cleanliness, ecological system, reduces land occupation;

-savesenergy sources and dramatically reduces costs.

Composite materials obtained on the basis of basalt fiber, fiber concrete allow to reduce the consumption of the main reinforcement elements in reinforced concrete construction.

Due to the strong connection of basalt fibers with concrete, the tensile strength of concrete increases by 20...40%, crack resistance and durability, durability, and other properties are significantly improved [3].

The presence of a large amount of portlandite Ca(ON)2 in concrete during the hardening process can have a negative effect on basalt fiber. Therefore, various active additives can be used to bind it: microsilica, metakaolin (thermally treated kaolin). As a result of adding basalt fiber and active additives to concrete, its water absorption is also increased, so it is advisable to use special superplasticizers [4]. Compositions based on basalt fiber and microsilica are presented in Table 1.

Table 1.

Compositions of concrete compositions with basalt fiber and microsilica

Raw material name	Size	Content without additives (T-0)	T -11 (micro)	T-12 (micro)	T-13 (micro)
Cement	kg	0,500	0,470	0,460	0,450
Sand	kg	1,500	1,500	1,500	1,500
Micro cream	kg	-	0,030	0,040	0,050
	%		6	8	10
Superplasticizer	kg	0,0015	0,0015	0,0015	0,0015
	%	0,5	0,5	0,5	0,5
Basalt fiber	%	0	1	2	3

Ohangaron portland cement was selected for the preparation of samples, construction sand with a particle size of no more than 2.5 mm, MK-85 TS 00186200-

12:2019 microsilica, superplasticizer JK-08 to control the rate of concrete hardening. 5 mm long basalt fibers obtained on the basis of Osmonsoi basalt rocks of "Forish Mega Invert" enterprise located in Jizzakh region were used as reinforcing fibers. Concrete, including an additional component, increases the resistance to shock loads or spreading to the uniform outflow of water.

The well-mixed material has a high class of cold resistance, is inert to chemical effects, and its viscosity is at the required level. The structure of cement with the addition of basalt fiber is very similar to cement reinforced with steel reinforcement, but its durability characteristics are explained by the high deformation and strength of the reinforcement.

The fiber itself can withstand a load of up to 2500 MPa - more than steel. When the basalt fiber is stretched, there is no plastic deformation, which allows it to withstand strong elastic deformation. Basalt fiber has high chemical resistance properties, the diameter of fibers is about 16-18 micrometers, but this parameter can change depending on what properties it will have after mixing all the parameters.

Basalt concrete is almost insensitive to the appearance of cracks in its structure, but this can be said only if enough fibers are included. In addition, the material has high resistance to natural and artificial cracks. Therefore, basalt concrete can be widely used in cases where reliable production that can be used for a long time is required. This is especially true for outdoor structures. Rainfall, sunlight and other factors have an additional negative effect here.

Forms that have passed the vibration process are transferred to hardening racks and kept for 48 hours (the hardening time of the products depends on the temperature and the additives added to the concrete, it can be reduced to 12 hours). After that, the products are removed from the mold. Forms are removed from the molds by hot water. The temperature of the water in the bath should be between 35 - 45 °C.

Water is constantly heated by electric heaters. Molded concrete tiles are placed on top of each other in the hot water bath until the bath is completely filled. Bath tiles are kept for 3-5 minutes until the form is heated. Then, as a result of impact, the tile easily leaves the form and is sent to the warehouse for storage.

Hardening of products continues in the shop on special pallets. In hot weather, the product should be moistened several times a day. In the cold season, products should be stored indoors at an air temperature of at least 15 °C. If the compressive strength of the slabs is 90% on a cold day and 70% on a hot day according to the compressive and bending strength of the concrete class, the product is allowed to be sold.

90% strength of this concrete composition is achieved after 10-11 days of hardening. May vary slightly depending on curing conditions and cement quality. 7, 14 and 28 days durability of concrete and basalt fiber reinforced concrete are presented in Table 2.

Physico-mechanical properties of concrete samples, including compressive strength of 7-, 14- and 28-day samples were determined in laboratory conditions using a 10-ton hydraulic press (Fig. 1).

Figure 1. Determination of mechanical strength of samples

Judging from the mechanical strength of fiber concrete samples, compositions with 2% basalt fiber were chosen as the optimal composition. It was observed that the strength of concrete with 2% basalt fibers increases from 34 to 38 MPa.

Table 2.

Durability of concrete and basalt fiber concrete at 7, 14 and 28 days

Sample	Compressive strength, MPa			
	Test 1	Test 2	Test 3	Average indicator
7 day samples				
Sample without additive (T-0)	185 kg/sm^2	185 kg/sm^2	190 kg/sm^2	186 kg/sm^2
Basalt fiber 1% (T-1)	195 kg/sm^2	190 kg/sm^2	188 kg/sm^2	191 kg/sm^2
Basalt fiber 2% (T-2)	200 kg/sm^2	205 kg/sm^2	195 kg/sm^2	200 kg/sm^2
Basalt fiber 3% (T-3)	195 kg/sm^2	200 kg/sm^2	190 kg/sm^2	195 kg/sm^2
14 day samples				
Sample without additive (T-0)	240 kg/sm^2	230 kg/sm^2	245 kg/sm^2	238 kg/sm^2
Basalt fiber 1% (T-1)	275 kg/sm^2	285 kg/sm^2	290 kg/sm^2	283 kg/sm^2
Basalt fiber 2% (T-2)	300 kg/sm^2	305 kg/sm^2	300 kg/sm^2	301 kg/sm^2

Basalt fiber 3% (T-3)	290 kg/sm^2	285 kg/sm^2	300kg/sm^2	291 kg/sm^2
28 day samples				
Sample without additive (T-0)	350 kg/sm^2	350 kg/sm^2	340 kg/sm^2	346 kg/sm^2
Basalt fiber 1% (T-1)	365 kg/sm^2	370 kg/sm^2	390 kg/sm^2	375 kg/sm^2
Basalt fiber 2% (T-2)	380 kg/sm^2	385 kg/sm^2	385 kg/sm^2	383 kg/sm^2
Basalt fiber 3% (T-3)	380 kg/sm^2	385 kg/sm^2	370 kg/sm^2	378 kg/sm^2

The main function of basalt fiber is to provide plastic properties and prevent cracking during compression. Basalt concrete can be used in various areas of modern construction projects. The use of the material is economically effective with a relatively low increase in price when it is necessary to increase a number of properties.

Basalt fiber concretes have high crack resistance, bending strength, abrasion resistance. Products made of such concrete are not reinforced with grids and frames, so the technology of their preparation is very convenient and requires relatively little labor.

References

1. Shevchenko V.P., Tokunov S.G., Gulamova D.D., Kim R.B., Turdiev D.Sh. Obtaining and research of properties of basalt fiber based on natural raw materials of Uzbekistan, Chemistry and chemical technology, Tashkent, 2011, No. 2, pp. 10-12.
2. O‘zbekiston Respublikasi Prezidentining 20.02.2019 yildagi PQ-4198

sonli “Qurilish materiallari sanoatini tubdan takomillashtirish va kompleks rivojlantirish chora-tadbirlari” tug‘risidagi qarori. https://lex.uz/docs/4207834

3. Парсаева, Н. Ж., Курбанов, З. Х., & Бобокулова, Ш. (2021). Исследование физико-механических свойств бетонных изделий используемые промышленные отходы. *Science and Education*, *2*(5), 417-423.

4. Хакимов, О. М., Курбанов, З. Х., & Мухаммедов, Ф. (2021). Реализация возможностей получения легких наполнителей на основе меньше пластиковых почв в нашей республике. *Science and Education*, *2*(5), 176-181.

5. Курбанов, З. Х., & угли Холбоев, С. О. (2021). Микроарматурализация сухих строительных смесей волластонитом. *Science and Education*, *2*(5), 410-416.

6. Курбанов, З. Х., & Сулайманов, Ж. Ж. (2021). Подготовка зданий к отделке местными материалами из натурального камня. *Science and Education*, *2*(5), 403-409.

7. Курбанов, З. Х., Мамиров, А. Х., & Махкамов, М. З. У. (2021). Улучшение процесса горения керамической плитки на заводе строительных материалов. *Science and Education*, *2*(5), 395-402.

8. Парсаева, Н. Ж., Курбанов, З. Х., & Расулова, Н. Б. (2021). Технология производства земляных работ с применением геосеток. *Science and Education*, *2*(12), 324-333.

9. Khamidulloevich, K. Z., Begalievich, A. K., & Sanjarbek, K. (2021). TECHNOLOGY OF PRODUCTION OF EARTH WORKS WITH THE APPLICATION OF GEOGRAPHS. *Oriental renaissance: Innovative, educational, natural and social sciences*, *1*(5), 267-271.

10. Курбанов, З. Х., Ганиев, А., & Усанова, Г. А. (2022). ИССЛЕДОВАНИЕ СОСТАВА СУХОЙ СТРОИТЕЛЬНОЙ СМЕСИ НА ОСНОВЕ МРАМОРНЫХ ОТХОДОВ. *Oriental renaissance: Innovative, educational, natural and social sciences*, *2*(1), 299-304.

11. Ганиев, А., Қурбонов, З. Ҳ., Усанова, Г. А., & Назаров, Ж. Ж. Ў. (2022). Тоғ-кон саноати чиқиндилари асосида олинадиган майда донали бетонлар. *Science and Education*, *3*(3), 258-263.

12. Ganiev, A., Tursunov, B. A., & Kurbanov, Z. K. (2022). Prospects for the use of multiple vermiculitis. *Science and Education*, *3*(4), 409-414.

13. Kurbanov, Z., & Parsaeva, N. (2022, June). Strong grinding based on local raw materials getting stones. In *AIP Conference Proceedings* (Vol. 2432, No. 1, p. 030104). AIP Publishing LLC.

14. Ганиев, А., угли Турсунов, Б. А., & Курбанов, З. Х. (2022). Особо легких бетонов полученных на основе сельского хозяйственных отходов. *Science and Education*, *3*(4), 492-498.

15. Nurmamatouv, N. R. (2022). Bazalt armatura ishlab chiqarishdagi chiqindi asosida fibrabeton tarkibini tanlash va xossalarini o'rganish. *Science and Education*, *3*(3), 146-152.

16. Nurmamatov, N. R., & Tilavov, E. N. O. G. L. (2022). Bazalt tolasi asosida fibrabeton optimal tarkibini tanlash va fizik mexanik xossalarini taxlili. *Science and Education*, *3*(3), 153-160.

17. Istamov, Y., & O'roqboyev, O. B. (2022). YUQORI MUSTAHKAM BETONLAR OLISHDA KIMYOVIY VA MINERAL QO'SHIMCHALAR YORDAMIDA FIZIK-MEXANIK XOSSALLARINI TADQIQ ETISH. *Журнал интегрированного образования и исследований*, *1*(1), 310-318.

18. Нурмаматов, Н. Р. (2022). Изучение процесса получения пенобетона на основе местного синтетического сырья. *Science and Education*, *3*(3), 291-295.

19. Баходиров, А. А., & Абдусаматов, К. Б. (2020). перспективы использования асбестоцементных отходов в качестве микрофибры при производстве газобетона. *IEJRD-Международный междисциплинарный журнал*, *5*(7), 5.

20. Абдусаматов, К. Б. (2022). Исследовательская работа по определению теплопроводности и термическое сопротивление образцов газобетона. *Science and Education*, *3*(3), 244-248.

21. Begalievich, A. K., & Abdulazizovich, B. A. (2022). Efficiency of Obtaining Wall Materials from Industrial Waste. *International Journal of Formal Education*, *1*(7), 134-139.