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IMPROVEMENT OF HYDROTECHNICAL PROPERTIES OF CONCRETE WITH THE USE OF ASH FROM THERMAL POWER PLANTS AND FIBERS

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Annotation: The article presents the compositions and physical and mechanical properties of raw materials for fiber-reinforced concrete based on fibers of igneous volcanic rock and thermoplastic polyme also the compositions and physical and mechanical properties of fine-grained concrete based on industrial waste and a chemical additive.

***Keywords*:** Dispersed reinforcement, composite fiber, basalt fiber-reinforced concrete, polypropylene, strength characteristics, density, humidity, Fine-grained concrete, industrial waste, chemical additive, ash, slag, strength, density, moisture.

The most important tasks of our time are to reduce the energy intensity of obtaining effective building composites, improve the environmental situation, and optimize the "man-material-environment" system. These problems are typical for the Republic of Uzbekistan, the priority development of which is the most important state task. It seems necessary to optimize the processes of structure formation of concrete mixtures through the use of industrial waste, which will improve the strength characteristics and significantly reduce the permeability of composites while protecting the heat-insulating layer of polystyrene foam. This will help to reduce the negative impact from the harmful emissions of expanded polystyrene during the operation of building envelopes, especially in extreme conditions, as well as improve the environmental situation in the region through the use of industrial waste.

Our research is devoted to the issue of using waste from the mining industry (sand of waste rock, waste from the extraction and processing of marble), energy industry (fly ash from thermal power plants), copper smelting industry (copper smelter slag) in the preparation of backfill mixtures used for backfilling goaf in underground mining works.

Thus, it has been established that fly ash can be used without processing as an additive in the grinding of cement clinker (up to 15% of the mass of cement) without changing the properties of cement clinker; plasticizing additive in light and heavy concretes, mortars (up to 60% of the mass of cement); raw materials for the construction and strengthening of road foundations (up to 20% of the mass of cement and sand); additives in the production of clay bricks (up to 45% of the volume of bricks); instead of sand in the production of lightweight concrete products (15-25% of the volume of aggregates); component for the production of local binders (up to 80% by weight of the binder) grades 75-400; raw materials for mineral fertilizers and neutralization of acidic soils in agriculture [1].

Fly ash refers to polymineral materials containing, depending on the type of coal burned, a different amount of a glassy phase (40-65%), in the form of spherical particles up to 100 microns in size, dehydrated clay substances, mullite, magnesite, quartz, various calcium compounds, magnesium, sulfur. In contrast to the coal enrichment rock, TPP fly ash does not contain coal as such, and its combustible part is represented by various modifications of coke residues.Depending on the coal deposit, fly ash is characterized by a different chemical composition. It should be noted that the chemical and mineralogical compositions, as well as structural and physical properties and the content of combustible residue in fly ash vary depending on the field of the electrostatic precipitator in which it is selected. This explains the fact that the technological properties of fly ash, its fusibility characteristics and the nature of the formation of the structure of the resulting building material will be different [2].

In the field of using the binding properties of ash, studies were carried out by domestic and foreign scientists Nudelman B.I., Tokhirov M.K., Gaziev U.A., Budnikov P.P., Bazhenov P.I., But Yu.M., Burov Yu .S., Kinas V.Z., Popov N.A. and others. The first qualification of fuel slags and ashes, based on the type of initial coal, was proposed by N.A. Popov [3]. Hydration products are: low-basic hydrosilicate CSH(B) as a result of a decrease in the concentration of lime in solution, hydrogelenite, monosulfate 3CaO·Al2O3·12H2O.

Along with these main new formations in ash binders, depending on the hardening conditions, the following characteristic formations of a crystalline phase are observed: under normal hardening conditions, gelsagonal hydroaluminates and hydrosulfoaluminates, during steaming, the beginning of the formation of hydrogarnets, and during autoclave treatment, an increase in the number of hydrogarnets.

Table-1 shows the chemical compositions of the ashes of the main coal basins, which have received the greatest use in construction or have been tested for this purpose. The presented set of evils of various coal basins can be considered as consisting of two classes. The first class includes ashes that, when mixed with water, can harden into a stone-like body. To the second class, hardening when mixed with water, but in the presence of lime, i.e. showing the properties of pozzolans.

Studies of the effect of lime and PAF additives on the strength of ash-cement compositions allowed the author to establish the optimal dosage limits: lime 5-6%, ACP, FESMAL and SDB-M-0.3% by weight "ash-cement".The introduction of these additives provides an increase in the strength of hydraulic concrete by 22-30%, and ash-cement composition by 25-34%. Therefore, in our opinion, it is rational to use the ash obtained at the Angrenskaya GRES as an additive to mortars and concretes in order to save binder and partially replace fine aggregates.

Of considerable interest to us are the studies carried out by scientists on the fly ash of the Angren State District Power Plant. In the works [4] Tokhirova M.K., Kasimova I.K. and others, it is recommended to use fly ash in hydrotechnical concrete to replace part of the cement in an amount of not more than 10-15%. This improves the workability of the concrete mixture, reduces shrinkage and heat release during concrete hardening.

Table -1. Chemical compositions of the sols of the main coal basins

№	Name of thermal power plants	P.P.P	Content, % for calcined substances						
			SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O $+K_2O$
1	Irkutsk (Angarsk)	5,0	60,5	20,7	5,4	6,4	1,20	0,2	следы
2	Krasnoyarsk	1,02	44,2	9,98	12,54	27,71	4,30	0,95	0,32
3	Nizhny Tagil	0,69	53,95	24,25	11,66	3,25	3,15	0,90	1,7
4	Novosibirsk	15,52	56,61	23,62	6,93	7,05	1,94	0,42	3,04
5	Stupino	1,34	47,35	34,2	13,5	1,72	1,84	0,40	-
6	Syzran	2,7	42,16	13,6	6,28	28,32	2,53	5,82	2,0
7	Sredneuralskaya (Ekibazstuzsky	5,35	57,66	33,18	3,20	0,62	0,30	0,13	0,19

	coal)								
8	Tom-Ustinskaya	11,78	59,60	22,4	10,27	5,34	1,08	0,22	0,19
9	Southern Kuzbass	9,15	55,51	31,04	5,73	4,24	1,21	0,44	1,83
10	Irsha-Borodinskaya (Kansko-Achinsk coal)	2,3	47,0	13,0	8,1	25,4	5,2	0,83	0,4
11	Angren	3,7	35,80	18,45	15,30	18,30	4,15	3,80	0,5

At the same time, ash slows down the process of concrete hardening in the initial period, reduces water permeability and frost resistance. But the introduction of a plasticizing - air-entraining additive based on the water-soluble SAFA resin made it possible to accelerate the hardening of concrete. Fly ash from the Angren SDPP with a fineness of 3500 cm2/g was used as a mineral additive, and its amount varied from 20 to 40%. High dispersion of ash, fusion of particles of different granulometry have a positive effect on the workability of the concrete mixture, especially with a low consumption of binder.

The combined use of active mineral and plasticizing-air-entraining additives provides up to 30% savings in cement in concrete grades 200-400 without compromising the workability and strength of concrete. At the same time, frost resistance increases up to 200 cycles, which is a consequence of the air content of concrete increased by 3-4%. Makhamadaliev I.M. [5] used fly ash from Novoangrenskaya GRES with Ssp.=300 m2/kg as a filler in the preparation of concrete mixes based on activated cement binder. Additives to cement were superplasticizer S-3, LST, KZhN - bottom liquid produced by sodium - carboxymethyl cellulose and SVK - introductory concentrated stock produced by Electrokhim Production Association.

He established the features of hydration of the filled cement binder with MNZ - a modified ash filler and that it is possible to obtain an ash-cement binder with a decrease in cement consumption by 28-50% and low water demand, all this makes it possible to obtain an ash-cement stone with increased structural and mechanical properties through the use of MNZ and high speed mixing.

Despite the large number of studies conducted by domestic and foreign scientists, confirming the promise of using fibers for dispersed concrete reinforcement, the mass use of fiber-reinforced concrete (FB) is constrained by insufficient knowledge of their durability in various operating environments. This is due, first of all, to the ambiguity of the results of studies of fiber resistance in cement media.

One of the promising directions for studying the technology of fiber-reinforced concrete is the rationale for the effectiveness of using non-metallic fibers such as basalt and polypropylene as a dispersion. As you know, non-metallic fiber is distinguished not only by high physical and mechanical properties, but also by chemical resistance, temperature - by light and weather resistance, and this, in turn, by the simplicity and low cost of production technology. In Uzbekistan, the use of fiber-reinforced concrete in the construction industry is given insufficient attention due to insufficient study of its properties and production technology, the presence of a fibrous filling raw material base and insufficient justification for effective areas of its use. Considering that in Uzbekistan (Forish, Jizzakh region) the production of basalt fiber has been mastered, and also given that the construction industry of Uzbekistan needs new modern efficient building materials, it was decided to choose as the topic of the dissertation: “Improving the properties of fibrobriton in various climatic conditions of Uzbekistan.

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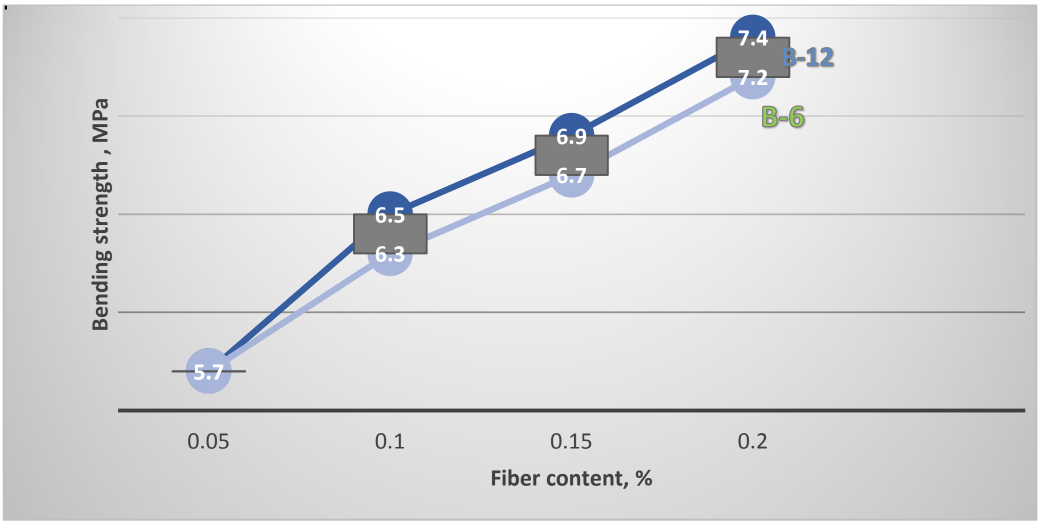

Figure 1. Graph of the dependence of the bending strength on the dosage of basalt fiber at the age of 7 days.

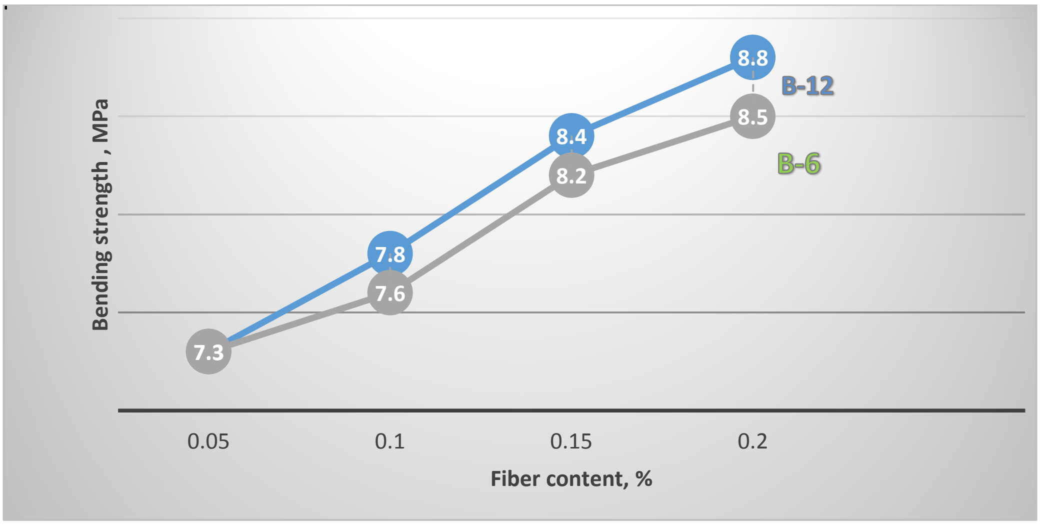

Figure 8. Graph of the dependence of the bending strength on the dosage of basalt fiber at the age of 28 days.

The efficiency of fine-grained concrete is determined by the difference in the reduced costs per 1m3 of fine-grained concrete. To determine the economic effect of a new type of fine-grained concrete, it is necessary to compare technical and economic indicators. The essence of the comparative analysis is that the comparison of the reduced costs shows how much cheaper the proposed composition of fine-grained concrete is. When comparing two options for producing fine-grained concrete, it should be noted that the same equipment was used in both options.

Based on the results of studies of the effect of introducing polypropylene and basalt fibers into fine-grained concrete, we can confidently speak of a significant increase in bending strength, since the effectiveness of the additive with the maximum dosage is 23.40% and 28.15%, respectively, proving that the fiber is an additive, increasing strength in accordance with GOST 24211-2008.

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