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Production of Modified Portland cement with Additions and Production of Special Concrete

B.T. Haitov., R.V. Aliqulov., S. A. Xolmurodova
Termez State University

Abstract: This article presents the results of research on the modification of Portland cement with additives derived from local raw materials for the production of special concrete. Modified Portland cement-based concrete products increase hardness, water resistance, anti-freeze and anti-corrosion properties, and enable large-scale production of high-quality concrete.

Keywords: Cement, concrete, natural vollostonite, dextrin, dolomite, hardness, strength.

Introduction: Cements of different composition and properties can be used to meet the needs of construction sites. However, due to the lack of raw materials, technological equipment and other reasons, the capacity of cement plants to produce a variety of cements is limited.

In such cases, better properties of the construction objects can be achieved by adding various additives to the portland cement and mofing it to provide special quality cements. It is possible to adjust the properties of cement and concrete through the added additives [1,2].

These additives are added to the cement composition during the clinker crushing stage or before preparing the concrete mix. The second option of adding additives to cement is more convenient and flexible, as it allows to optimize the composition and properties of cement with additives in order to obtain concrete of the desired quality and purpose [3,4].

Modification of cements with additives allows the production of concrete products based on portland cement with properties such as high hardness, water absorption, frost and corrosion resistance at minimal labor and financial costs [5,6,7]. Giving such specific properties to concrete is very important for hydraulic engineering and concrete products on the road, foundations of buildings, sewer structures. Concrete for these products and structures is tested for resistance to saline groundwater. They have an aggressive effect on the concrete, causing corrosion. Absorbs concrete products and reduces their durability [8]. Corrosion of concrete is a simple and common phenomenon in Uzbekistan. The hot climate of Uzbekistan promotes the crystallization of salts in groundwater in concrete pores. This leads to its collapse.

Practical significance of the research: Chemical and mineral additives are used in the modification of cement. Chemical additives are mainly water-soluble compounds that are able to reduce the surface tension between the particles and increase their mobility in the cement-water system without increasing water consumption. As a result, it increases the level of formation and compaction of the concrete mix, decreases the porosity of the cement stone, which reduces the water absorption of the concrete structure. This results in increased strength, waterproofing and frost resistance properties. The corrosion resistance of concrete depends not only on the structural density of the cement stone, but also on the mineralogical composition and hardness of the minerals in the cement [9]. The mineralogical composition of cement can be changed by adding mineral additives to it.

If the additives added to the cement composition, the cost of its preparation, and the application values are lower than the cost of the cement currently in production, then the production of modified cement is considered cost-effective. However, in the case of construction of important economic facilities, it is

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advisable to use additives in order to increase the durability of construction structures, regardless of the cost obtained during the application. In such cases, one-time costs are covered by increasing the service life of concrete products in the future.

For mass modification of cement, it is advisable to add wastes from local raw materials and other industries as additives. When using wastes from other industries, it further increases the efficiency of cement modification by using the wastes and improving the ecological condition of the area where it is located. Over the years, we have conducted systematic research on the development of technology for obtaining some chemical and mineral additives, waste from local raw materials and other industries, the composition and properties of concrete in modified cements and their implementation in various structures of some enterprises in Uzbekistan.

In our research, we used the following as mineral supplements

1. natural vollostonite;

2. chemically obtained limestone;

3. river sand;

4. waste of ceramic bricks;

5. crushed expanded clay;

6. wastes of fluorite ore flotation industry;

7. powders of cement clinker kilns;

There are several deposits of natural vollostonite in Uzbekistan, such as Nakpai, Western Djangalik, Akbulak, Mingbulak, and others. Due to its modifying properties, vollastanite is a very effective additive that can replace up to 40% of the cement in concrete, while at the same time helping to produce products with high strength and corrosion resistance.

Experimental part: Mineral raw material for obtaining the above 2 and 3 additives is the most common in the country, these additives can replace up to 20% of the cement in the concrete.

The 4-7 mineral additives mentioned above are derived from the corresponding wastes of other industries. Of these, 6 have the largest raw material reserves. This is because the oxides in the waste formed during the flotation method are the same as the oxides in the cement. These oxides are combined into different minerals, their composition is also different, so the effectiveness of the effect of mineral additives on the process of changing cement is also different, which can be seen from the results of experimental studies conducted below. For comparison, Table 1 shows the chemical composition of some of the additives.

Table 1: Chemical composition of mineral additives added to cements

Mineral supplements	Amount of oxides, mass. %							
	CaO	SiO_2	AL_2O_3	Fe_3O_4	MgO	Na_2O K_2O	MnO	Other oxides
Vollastonite	45,76	47,4	0,79	0,71	0,39	0,03	0,53	4,39
Limestone	57,57	2,62	0,93	0,7	2,23	-	-	41,95
OTMK waste	6,28	74,54	7,33	1,73	0,45	3,55	0,12	6,0
Clinker kiln dust	50,71	14,81	3,65	3,08	2,67	-	-	25,08

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The following chemical additives were used in the study:

1. dextrin;

2. modified technical lignosulfonate (OTL);

3. Alkaline cotton stalk extract (PIE);

4. A mixture of the 3 additives mentioned above

Dextrin is obtained from potatoes and corn, obtained by treatment of OTL technical lignosulfonate solution with lyoss, PIE cotton stalk is separated by treatment with NaOH solution. Complex additives are obtained in different proportions from dextrin, OTL, and PIE [1]. Chemical additives are obtained on the basis of plants and the source of raw materials for their production is unlimited and renewable. In addition, their consumption in concrete is only 0.01 ... 0.1% of the cement mass, which does not significantly affect the cost of modified cement. For example, 220 tons of cement can be modified with 1 ton of dextrin. Reduces cement consumption in concrete by 15 ... 20%, ie. 30 ... 40 t ga teng. Of course, the cost of this amount of cement will be significantly higher than the amount of dextrin used.

In some cases, modification of cement is carried out by adding mineral and chemical additives to its composition.

It should be noted that in the modification of cement, the additives not only provide specific properties, but also reduce the consumption of cement in the concrete without reducing the quality of the resulting concrete. In this case, the above-mentioned chemical additives reduce the consumption of cement by 20 ... 25%, and mineral additives are equal to their mass embedded in concrete [7-10].

Here are some of the results of research that confirm the effectiveness of modified Portland cement with additives, which give specific properties to concrete. Figure 1 shows the specific effect of additives on the hardening hardness of concrete under normal conditions of samples containing 1: 1.51: 2.57: 0.4 (binder: sand: crushed stone: water). As can be seen from this picture, all additives increase the strength of concrete, especially complex compositions.

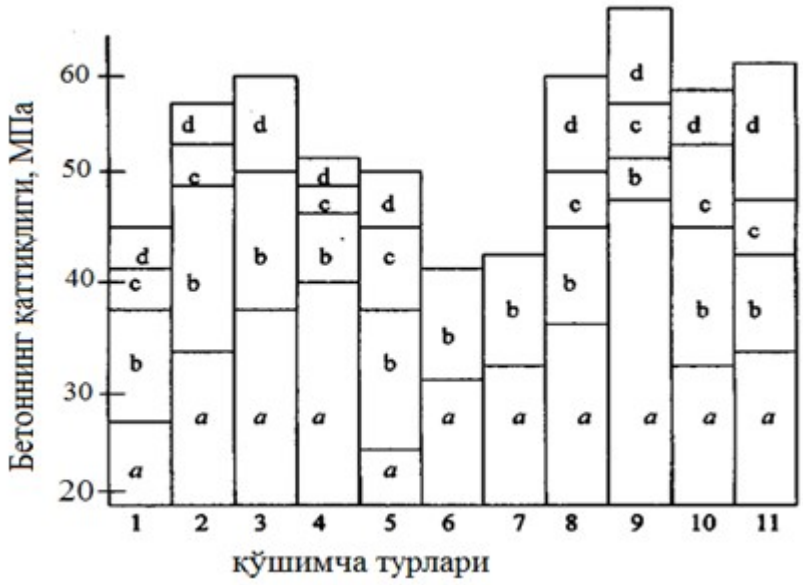

Figure 1: Dependence of the hardness of concrete on hardening under the influence of various additives. a - 7; b - 28; s - 180 and d - 360 days. Under normal conditions for samples with the following composition: 1 - without additives; 2 - O'TL; 3 - dextrin: 4 - wollastonite: 5 - fluorite-

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enriched wastes; 6 - limestone; 7 - dusts of clinker kilns; 8 - wollastonite + O'TL; 9 - vollastite + dextrin; 10 - fluorite enrichment waste + OTL; 11 - fluorite enrichment waste + dextrin.

Figure 2 shows the effect of some additives on the water-repellent (a) and frost-resistant (b) properties of concrete of different compositions mentioned above. The water absorption of concrete with additives is almost doubled, and the frost resistance is 0.9 ... 0.97 after 500 cycles of testing, while for concrete without additives it is only 0.65.

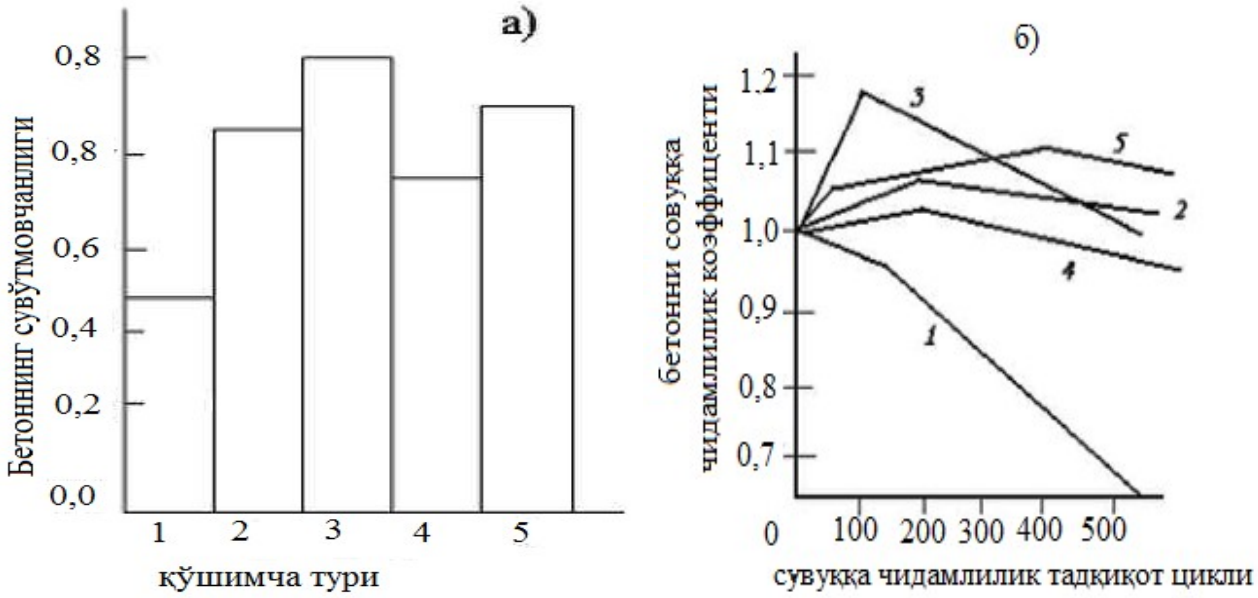

Figure 2. Impermeability (a) and frost (b) resistance of concrete samples without additives (1), with OTL additive (2), dextrin (3), vollostonite (4) and a mixture of vollostonite with dextrin (5).

Table 2: Coefficient of strength and corrosion resistance of concrete in mineral acid solutions.

Dextrin consumption,% cement mass	Coefficient of strength and corrosion resistance of concrete in acidic solutions over time					
	30	180	360	30	180	360
	0,5 моль/л H_2SO_4			0,1 моль/л HCl		
	35/0,92	24/0,52	17/0,36	36/0,93	28/0,75	22/0,57
0,03	43,1/0,92	28/0,55	28/0,41	42,3/0,95	38/0,82	40/0,68
39/0,60	39/0,61	39/0,62	39/0,63	39/0,64	39/0,65	39/0,66

The effect of various aggressive substances on the corrosion resistance of various admixtures was studied for 360 days. Table 2 shows the values of strength and durability coefficients of very aggressive solutions of H2SO4 and HCl with dextrin and dextrin-free concrete samples for comparison. We can see that the additions have significantly increased the corrosion resistance of the concrete.

Modification of cements with additives is explained by the increase in strength, water resistance, frost resistance and corrosion resistance of concrete obtained from it, the additives help to reduce the porosity of cement stone and form high-strength products that harden cement minerals in concrete.

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Conclusion: When dextrin is added to the cement, the porosity of the cement stone is reduced from 500 ... 1000 nm to 10 ... 500 nm. If wollastonite is added to the cement, mainly high-strength calcium hydroxide is formed. It produces high quality concrete.

Thus, the above data show that it is a reasonable method to obtain high-quality concrete from Portland cement modified with mineral and chemical additives on the basis of local raw materials and use them in the production of various construction products.

PUBLICATIONS:

1. Батраков, В.Г. Модификаторы бетона: новые возможности и пер-спективы . Строительные материалы. – 2006. –№ 10. – С. 5–7.
2. Тараканов О.В. Бетоны с модифицирующими добавками на основе вторичного сырья. – Пенза: ПГУАС, 2005.
3. ГОСТ 30459–2008. Добавки для бетонов и строительных растворов. Методы определения эффективности. – М., 2003.
4. ГОСТ 24211–2008. Добавки для бетонов и строительных растворов. Общие технические условия. – М., 2003.
5. Добролюбов, Г. Прогнозирование долговечности бетона с добавка- ми – М.: Стройиздат, 1983.
6. Кунцевич, О.В. Бетоны высокой морозостойкости для сооружений Крайнего Севера– Л.: Стройиздат, 1989.
7. Шейкин, А.Е. Цементные бетоны высокой морозостойкости [Текст] /А.Е. Шейкин, Л.М. Добшиц. – Л.: Стройиздат, 1989.
8. Ингибиторы коррозии стали в железобетонных конструкциях– М.: Стройиздат, 1985.
9. Мчедлов-Петросян, О.П. Гидратация и твердение цемента Цемент. – 1980. – № 12. – С. 10–11.
10. Саломов, А. А., & Хуррамов, Р. С. (2019). ТЕОРЕТИЧЕСКИЕ АСПЕКТЫ РАЗВИТИЯ ЛОГИЧЕСКОГО МЫШЛЕНИЯ НА УРОКАХ МАТЕМАТИКИ В НАЧАЛЬНОЙ ШКОЛЕ. Интернаука, (41-1), 12-14.

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