RESEARCH PARKS

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGIES

www.journalsresearchparks.org/index.php/IJOT e-ISSN: 2615-8140|p-ISSN: 2615-7071

Volume: 02 Issue: 11 | November 2020

Water and air resistance of filling mixtures and the influence of aggressive media on their durability

Rakhimov Shavkat Turdimurotovich[1], Gaziev Uchqun Abdullayevich[2], Eshbayeva Farida Rismatovna[3]

[1]Doctor of philosophi (PhD) on technical Sciences, Associate Professor of the Department "Technology of building materials, products and structures" Tashkent Institute of Architecture and Civil Engineering, Uzbekistan

E-mail: raximov.12081979@mail.ru

[2]Candidate of technical Sciences, Professor of the Department "Technology of building materials, products and structures" Tashkent Institute of Architecture and Civil Engineering, Uzbekistan

[3]Senior Lecturer of the Department "Technology of building materials, products and structures" Tashkent Institute of Architecture and Civil Engineering

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Abstract- *The article presents studies of water resistance and air resistance of filling mixtures based on industrial waste and the effect of aggressive media on their durability. The influence of the quantity and quality of copper-smelting slag and fly ash on the resistance of filling mixtures in various aggressive environments has been investigated. It has been established that the use of copper-smelting slag, with a low content of harmful impurities, makes it possible to obtain a slag-cement binder that is more resistant to aggressive media.*

Keywords: *filling mixture, water and air resistance, durability, strength, superplasticizer, copper smelting slag, ash, cement.*

1. INTRODUCTION

Determination of water resistance and air resistance and the influence of aggressive media on the durability of filling mixtures based on industrial waste.

Fillers were first used in Uzbekistan in the 90s of the last century at the Almalyk Mining and Metallurgical Combine. These alloys were used to fill gaps in the mountains during the extraction of copper, gold and other non-ferrous metals, to increase labor productivity in the extraction of ores, and to strengthen mountain massifs. Portland cement and slag portland cement were used as binders in the mixture, and sand and crushed stone obtained by crushing rocks were used as fillers. Consumption of binders was 150 - 200 kg per 1 m^3 of mixture, fillers 1000 - 1200 kg. The strength of the solidified aggregate was 2 - 4.8 MPa [1].

This is due to the higher impermeability of mortars and concretes on these cements and the binding of easily leachable calcium oxide hydrate to sparingly soluble calcium hydrosilicates with hydraulic additives. The increased water resistance of solutions on pozzolanic cements is due to the swelling of the gel-like components of the cement stone and the hydraulic additive in the presence of an aqueous solution of calcium oxide hydrate [2].

There is also sufficient evidence that products based on pozzolanic cements acquire insignificant strength when stored in air [3]. This phenomenon is also typical for Portland cement, but with pozzolanic Portland cements it is much more pronounced.

Some authors who have investigated this issue [4] emphasize that the structure of the initial hydraulic additives is of great importance for the air resistance of pozzolanic binders. Acidic additives such as tripoli and diatomite, the

www.journalsresearchparks.org/index.php/IJOT e-ISSN: 2615-8140|p-ISSN: 2615-7071

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particles of which are characterized by extremely high porosity and the ability to adsorb a significant amount of water vapor from humid air and release them in a dry environment, when added to cements, impart reduced air resistance to them.

When more dense hydraulic additives are added to Portland cements (cracks, fuel slags, fly ash), binders are obtained that are more stable when hardened in air-dry conditions. Cements with such additives differ little in air resistance from Portland cement.

There is no single method for determining the water resistance and air resistance of binders. Usually, these characteristics of a binder are judged by the indicators of the mechanical strength of samples from a solution or concrete on a given binder during long-term storage in water and in air.

Many researchers who have studied the properties of concrete on Portland cements with the addition of fly ash do not cite special studies to determine the water resistance and air resistance of these materials. The addition of Portland cement to the lime-ash binder, as well as steaming and steaming of the samples, led to an increase in their air resistance due to the compaction of their structure.

2. MATERIAL AND METHODS:

According to a number of researchers, an indicator of the air resistance of binders, to a certain extent, is their resistance to variable moisture and drying. We have presented laboratory experiments to determine the mechanical strength of samples from standard solutions of composition I: 3 with the same mobility on Portland cement with the addition of fly ash, copper-smelting slags and superplasticizer, during their long-term storage in air-dry conditions, as well as in water. Five series of samples were prepared with twelve prisms measuring 40x40x160mm.

After 28 days of curing the samples in humid conditions at a temperature of 20 ± 2 ° C, a relative humidity of 60-70%, six samples from each composition were placed for further hardening in water at a temperature of 20 ± 2 ° C, and six for hardening in air-dry conditions. After 28 and 60 days, the beams were tested for bending, and their halves were tested for compression. The results of determining the mechanical strength of the samples are presented in table-1.

Table 1

Mechanical strength of samples of water and air storage

Images	Composition vyajushchego, by mass,%				Mix composition	Curing conditions	Predel prochnosti obraztsov, MPa	
							28 days	
	portland cement	Fly ash	Slag from copper smelting production	Frem-C3 superplasticizer			bending	under compression
1	100	-	-	-	1:3	air dry	4,57	20,96
						in water	3,98	16,72
2	80	20	-	-	1:3	air dry	4,92	21,91
						in water	4,33	18,44
3	80	-	20	-	1:3	air dry	4,38	18,56
						in water	4,22	17,52
4	80	20	-	2	1:3	air dry	5,21	25,52
						in water	4,26	17,68
5	80	-	20	2	1:3	air dry	5,11	24,82
						in water	4,08	17,42

One of the main requirements for cements is their resistance to aggressive media. The fact that concrete structures made of cement do not always turn out to be sufficiently durable when exposed to certain natural waters has been established long ago. It has also been found that Portland cements corrode rather quickly in soft, acidic, carbonic waters and containing some mineral salts.

In the development of issues of corrosion of binders, the leading role belongs to the famous scientists A.A. Baykov, V.A.Kindu, A.R. Shulyachenko, N.A. Belelyubsky, V.N. Yung, P.P. Budnikov, S.D. Okorokov, VM Moskvin, VV Stolnikov, AV Volzhensky, U. Gaziev, Le Chatelier, Lafum, Kimo, Turrigiani, Rio, Lee, etc. [2, 5]. The work of these researchers made it possible to understand the causes of corrosion. It has been

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www.journalsresearchparks.org/index.php/IJOT e-ISSN: 2615-8140|p-ISSN: 2615-7071

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established that the corrosion of Portland cement mortars and concretes under the influence of waters of various compositions is caused by the following factors:

-physical dissolution in soft fresh water of some constituent parts of the hardened Portland cement stone, primarily calcium oxide hydrate;

-interaction of the components of the hardened cement stone with the free acids contained in the water;

- exchange reactions between calcium oxide hydrate (and other constituents of cement stone) and salts contained in mineralized water.

It is known that increasing the resistance of Portland cements against the action of aggressive media is associated with the introduction of hydraulic additives into their composition. The increased resistance of pozzolanic cement against sulfates and sea water has long been a subject of discussion. However, there is still no consensus on explaining the reasons for the increase in the resistance of cement in an aggressive environment with the introduction of additives.

F.M. LEE is of the opinion that it is explained in part by the binding of calcium oxide hydrate formed during the hydration of Portland cement, as well as the formation of a protective film around the more vulnerable aluminate compounds from the hydrosilicate reaction products between lime and pozzolana [4].

According to V.M. Moskvin, the limiting concentration of Ca(OH)2 in its pores, at which a chemical equilibrium occurs between it and this hydrosilicate or hydroaluminate, is essential for the stability of the cement stone [5]. When the concentration of CaO is equal to or greater than the limit, hydrolysis of hydrosilicates and hydroaluminates does not occur.

It is concluded that the introduction of 15-20% additives to Portland cement practically does not change its resistance against the sulfate action of soft water and sulfate-magnesium aggression and significantly increases its resistance against sulfate-aliminate-gypsum corrosion. Taking into account the phase composition of the cement slag stone, one should expect a high resistance of the filling mixtures based on Portland cement with the addition of copper smelting slag in various aggressive environments.

3. RESULTS

It is known that the quality and quantity of copper smelting slag and fly ash play a decisive role in making Portland cement resistant to aggressive media. Based on this, a number of experiments were carried out to determine the resistance of Portland cement with the addition of copper smelting slag in solutions of various salts. (table 2).

Table 2

Corrosion resistance of samples in various environments

№	Compositions	Compressive strength, MPa 28 days storage				
		In the water	Na_2SO_4	$MgSO_4$	Na_2CO_3	$CaCl_2$
1.	Portland cement-80% Fly ash-20% Water-25%	34,01	38,21	32,07	30,26	35,02
2.	Portland cement-80% Copper smelting slag-20% Water -25%	30,39	37,78	31,56	29,53	34,28
3.	Portland cement-80% Fly ash -20% Superplasticizer-2% Water -22%	34,83	35,08	34,71	33,41	38,81
4.	Portland cement-80% Copper smelting slag -20% Superplasticizer-2% Water -22%	33,87	36,93	31,71	31,98	33,21
5.	Tolerance coefficient indicator	- - - -	1,12 1,24 1,01 1,09	0,94 1,04 0,99 0,94	0,89 0,97 0,96 0,95	1,03 1,12 1,11 0,98

Note: solutions -Na_2SO_4-10 g / l; $MgSO_4$-30 g / l; Na_2CO_3-30 g / l; $CaCl_2$-30 g / l.

4.DISCUSSION

Resistance was studied on mortar samples with dimensions of 20x20x20mm, made from a test of normal density at the same ratios of Portland cement and copper-smelting slag (fly

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Volume: 02 Issue: 11 | November 2020

ash) and superplasticizer equal to 80: 20: 2, which had hardened for 28 days in humid conditions. After 28 days of hardening in humid conditions, the samples were placed in a solution of sodium sulfate, magnesium sulfate. For comparison, some of these samples were also left to solidify in water [6].

The concentration of solutions is taken according to the guidelines for determining the corrosion resistance of cements and concretes, developed in the concrete laboratory of the VNIIG named after B.E. Vedeneev. For comparison, a corresponding number of samples were left to solidify in ordinary tap water. After keeping in solutions, within the recommended time frame, the samples were tested for compression. The ratio of the compressive strengths of specimens in an aggressive environment and water is determined by the coefficient of resistance of the CW, which characterizes the change in the strength characteristics of the binder over time. The results of determining the coefficient of resistance of the samples in terms of 28, 60 and 90 days are presented in table 2.

5. CONCLUSION

It has been established that the addition of 20% fly ash to Portland cement does not impair the mechanical strength of samples on such a binder when they are hardened in air-dry conditions. During hardening in water, the strength of samples on Portland cement with the addition of 20% fly ash continuously increases, which coincides with the period of active interaction of fly ash with Ca (OH)2. However, it was found that there was a difference between the strength of the samples stored in water and in dry air. The results of our research show that mixtures based on composite binders are sufficiently resistant to the effects of water and air.

According to the results of the study, presented in Table 2, it is possible to determine that the most aggressive of all the studied medium, as for cement, as well as for cement-shlakovogo vyajushchego yavlyaetsya solution MgSO4. Addition of medeplavilnogo slag and zola-unosa to portland cement does not affect otritsatelno na ix stoykost against razlichnyx aggressive environments. By adding FREM C-3 superplasticizer to the mixture, it increased their resistance to various aggressive environments.

REFERENCES

1. Rakhimov Sh.T. Development of optimal compositions, research of physical and technical properties, durability and effectiveness of filling mixtures based on industrial wastes // Abstract of the dissertation of the Doctor of Philosophy (PhD) in technical sciences, Tashkent, 2019. -10-12 P.
2. Volzhensky A.V., Burov Yu.S., Vinogradov B.N., Gladkikh K.V. Concrete and products made of slag and ash materials. Moscow. –Stroyizdat. -1969.-S.389-392.
3. Gaziev U.A. "Industrial waste in the production of building materials and products". Textbook. - Tashkent. -2015. -S.232-242.
4. Lee F.M. Chemistry of cement and concrete. -M .: Gosstroyizdat.-1961.-P.271-293.
5. Moskvin V.M., Ivanov F.M., Alekseev S.N., Guzeev E.A. Corrosion of concrete and reinforced concrete, methods of their protection. -M .: "Stroyizdat". -1980.
6. Rakhimov S.T. Waste mining industry to fill the open space / Gaziev UA, Rakhimov SH.T. / Materials of the international scientific-practical conference "Research in construction, heat and gas supply and energy supply." - Saratov.-19-20 November.-2016. -87-89.P