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Strength Indicators Of Cement Systems With Additives Of Surface - Active Substances

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ABSTRACT

In the article, the study was to establish the effect of surfactant additives on the strength characteristics of cement systems. The determinations were carried out on cements of various mineralogical composition, freshly ground and stale, on cement-sand mortars and concretes. For control samples and with additives, the same plasticity was chosen, and the water-cement ratio than for various additives fluctuated within certain limits.

KEYWORDS

Additive, plasticity, solution, cement-sand, strength, water-cement ratio.

INTRODUCTION

The aim of the research was to establish the effect of surfactant additives on the strength characteristics of cement systems. Determinations were carried out on cements of various mineralogical composition, freshly ground and stale, and on cement-sand mortars and concretes. For control samples and with additives, the same plasticity was selected, while the water-cement ratio than for various additives fluctuated within certain limits. Ultimate strength in compression, bending and elastic modulus were determined for mortar

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samples on beams 4x4x16 cm and cubes 7.07x 7.07x 7, 07 cm, and for concretes on cubes 10x10x10cm and 20x20x20cm. [3.8.2].

It is known that, in a number of cases, when using mylonft, there is some lack of strength at the initial stage. A decrease in the strength of products on hydrophobic cements was observed only on freshly ground cements when molding samples with a high water-cement ratio. Therefore, a large number of comparative tests of the strength of samples on hydrophobically plasticized and control cements were carried out. The tables below show the results of these tests.Table 1 summarizes the test results of ordinary cement (I-B and I D and cement with a high content of C3C (3-C and 5-I).

As follows from the data in the table, cement mortars with OP with a decrease in the water-cement ratio (at different plasticity) are characterized by increased compressive and flexural strengths in comparison with the control values in all test periods up to a year. In this case, the optimal dosage of OP is in the range of 0.15-0.30%, the strength of the samples on such cement samples increases by 10-12% in comparison with the control ones. Mortars with OP additives, made with the same water-cement ratio as the control ones, are characterized by a shortage of strength (about 5%) in the initial hardening period (3 days) and equalization of the strength values to 28-day hardening (cement ID). [1.6.5].

The addition of mylonft, in spite of the decrease in the water-cement ratio, in some cases yields a 5-8% shortfall in strength compared to the control ones, even after 360 days of hardening. The greatest increase in strength is achieved when using a synthetic fatty acid of the C7-C9 fraction. The introduction of this additive increases the strength of samples at 3 days of age by 50%, at 28 days of age by 35% and 360 days of age - by 25%.

Table 1. the results of tests of lborotorny salted cements and mortars based on these cements are given. The addition of oxidized petrolatum in all cases causes an increase in the strength of the cement and when tested at 3,7 and 28 days of age, despite the increase in the normal density of the cement paste, the increase in strength is explained in this case. First of all, an increase in the specific surface area of cements when grinding them with OP additives. The introduction of oxidized petrolatum in an amount of 0.25% increased the plasticity of the solutions (increasing the value of the slump of the cone), did not reduce the strength indicators even with water-cement ratios the same as those adopted for the control compositions[7.4.3].

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Table 1

Results of testing cement and mortars with oxidized petrolatum additives (composition 1: 3)

Type of cement	Fineness of grinding residues on sieves,%		Normal goose tota cement leg dough	Uniformity of volume change			Grasping time		Testing of cement according to GOST 31108-2016		
				in de	in pa pah	boiling chenie	On the rook	end	Ultimate compressive strength kg / cm² at age		
	900 otv	4900 otv							3	7	28
No additive	0,365 0,365	7,485 7,485	22 22	в в	В в	В в	2^{20} 2^{20}	4^{10} 4^{10}	218 218	297 297	
With additive OP - 0,15	0,176 0,176	2.1 2.1	25 25	в в	в в	в в	2^{55} 2^{55}	4^{55} 4^{55}	242 242	349 349	
With additive OP - 0,25	0,15 0,15	1,45 1,45	25 25	в в	в в	в в	2^{43} 2^{43}	5^{25} 5^{25}	303 303	400 400	
With additive OP- 0,10 and CHB-0,015	0,15	2,0	25	в	в	в	3^{2}	5^{40}	287	411	

Ultimate bending resistance kg / cm² aged			Cone draft in cm	ATC	Volumetric weight of the solution kg / m³	Compressive strength kg / cm²					
						Samples of normal storage			Water storage samples		
3	7	28				3	72	28	7	28	
15,7 15,7	17,7 17,7		4,5 4,0	0,54 0,58	2,13 2,23	76 49	84 130	165 171	102 130	197 191	
14,8 14,8	19,2 19,2		5,5 5,5	0,545 0,53	2,10 2,16	53 68	76 104	168 162	98 112	145 192	
18,5 18,5	22,5 22,5		5,56	0,545 0,53	2,09 2,15	72 75	86 121	1447 170	102 104	187 193	
18,2	1,7		6	0,53	2,15	61	96	151	103	185	

Table 2

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Strength indicators of cements (in plastic mortars 1: 3)

Designation	Additive		IN C	Ultimate strength, kg / cm2 at						modulus of elasticity E = 104 kg / cm2		
cementov	Naimenovanie	Dosierov ing,%		Compression			Bending			3 дня	28 дня	360дней
				3 дня	28 дней	360 дней	3 дни	28 дней	360 дней			
I-V	No additive		0,45	163	285	345	32,4	55,0	58,0	22,3	35,0	38,0
I-V	OP		0,44	172	303	386	37,1	57,0	58,0	23,1	35,2	33,8
I-V	OP		0,43	182	330	375	44,0	60,0	63,0	26,0	36,6	36,8
I-V	OP		0,43	180	310	360	42,6	60,0	61,0	25,8	36,2	36,0
I-V	OP		0,46	164	224	222	32,5	60,8	51,5	26,8	33,0	33,5
			0,46	159	248	245	32,0	52,8	57,0	25,8	33,4	34,7
I-V	OP		0,46	148	210	220	35,0	51,7	57,0	26,8	35,6	34,0
I-V	OP		0,46	154	184	200	36,9	50,3	64,0	27,7	35,8	33,0
3-C	No additive		0,42	203	368	-	48,2	60,0	-			-
3-C	OP		0,39	220	391	-	51,2	68,0	-			-
3-C	MH		0,39	183	340	-	57,0	68,0	-	29,5	37,1	-
5- II	No additive		0,45	102	194	305	31,0	49,0	45,5	22,0	30,4	30,6

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5- II	OP		0,44	147	243	330	38,7	58,4	59,5	24,7	38,17	34,0
5- II	C_7-C_9		0,43	151	260	380	35,5	50,5	59,0	23,0	32,8	34,0
5- II	C_{10}-C_{16}		0,45	126	185	310	31,5	46,5	52,0	22,0	32,0	33,2
5- II			0,43	98	191	279	30,4	50,8	56,0	25,0	43,0	33,7

Based on the technical and economic analysis of the results of experimental work and production volumes of various surface-active additives, at present, the following additives can be recommended for implementation in the practice of hydraulic engineering: oxidized petrolatum in an amount of 0.20-0.22% and vat residues of the synthesis of fatty acids in the amount of 0.22-0.25% by weight of the cement. In some cases, it is advisable to use a combined additive of these surfactants in a mixture with sulfite-alcohol stillage (0.07-0.12%) or other hydrophobic additives. Good results are achieved when oxidized petrolatum or distillation residues are added to cement systems in a mixture with machine oil, spindle oil or similar oil in an additive: oil ratio = 163.

Table 3

Influence of surface active additives on the basic physical and mechanical properties of concretes

Supplement type	Dosage,%	V / C	Cone draft, cm	Conveniently Styles availability	Volume weight, kg / dm3	Compressive strength in kg / cm		
						3 day	28 day	180 day
No additive	-	0,425	0,4	28	2,40	240	365	365

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OP	0,22	0,395	1,0	24	2,39	245	395	400
OP plus PRS	0,22 0,10	0,383	1,0	22	2,40	218	420	420
VAT residues	0,20	0,400	0,80	28	2,40	215	380	390

CONCLUSION

The results of testing solutions on slag Portland cements and clinker cements are given in table. 1 and 2. Consumption of cement in solutions with oxidized petrolatum decreased slightly in comparison with the control. Samples were subjected to normal air and water storage. As follows from the data, in most cases, the addition of oxidized petrolatum increased the strength of the solutions in comparison with the control. The combined addition of oxidized petrolatum and SNB somewhat lowers the strength of the solutions during all test periods. Particularly interesting results were obtained when testing samples of air storage.

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