



Of Jks-1 Malein Sopolymer Additive On The Physical And Mechanical Properties Of Cement Binder

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ABSTRACT

The article presents the results obtained in determining the physical and mechanical properties of the cement composition with JKS-1 malien copolymer chemical additive.

Keywords:

Portland cement, JKS-1 maleic copolymer chemical additive, density, strength, physico-chemical and physico-mechanical properties.

The creation of energy and resource-saving environmentally safe cement compositions for buildings and structures and the introduction of innovative technologies in the construction industry is an urgent problem of today. In the science of concrete science, it is important to create fast-hardening, high-strength compositions that are resistant to operational conditions. In this field, the use of new types of chemical complexes is highly effective. In particular, the creation and introduction of new generation superplasticizers into concrete technology differs from the previous ones in terms of energy and resource efficiency. With the use of these additives in concrete technology, it is possible to increase the flexibility of the

mixture, its initial strength by 30-50%, improve its cold resistance, density and other properties. In this case, the temperature and time of heat treatment of concrete products are drastically reduced [1].

To improve the quality of cement compositions, it is very important to use highly effective plasticizing additives. Superplasticizers - organic chemical additives are used in the construction industry in order to regulate the structure formation processes and rheological properties of concentrated suspensions, which allow to change the mobility (spreadability) of raw materials and the properties of finished products according to the purpose. One of the urgent tasks is the research on identifying and finding new

effective additives that allow modification of the surface of the phase part [2].

Research work was carried out to determine the physico-chemical and physico-mechanical properties of JKS-1 malien

copolymer chemical additives in cementitious compositions used in concrete and reinforced concrete structures used in various buildings and structures [3].

Table 1.
Mineralogical composition of cements

| No | Type of cement | Amounts of major minerals | | | | Additive amounts | |
|----|----------------|---------------------------|------------------|------------------|-------------------|------------------|-----------------|
| | | C ₃ S | C ₂ S | C ₃ A | C ₄ AF | Opoka | SO ₃ |
| 1 | PTs400 D0 | 57 | 21 | 4.6 | 14 | 8 | 2.2 |
| 2 | PTs400 D20 | 54 | 20 | 11 | 12 | 9.2 | 2.8 |
| 3 | PTs500 D0 | 62 | 17 | 4 | 14 | - | 0.09 |

Table 2.
Chemical composition of cements

| No | Type of cement | Chemical composition, % | | | | | | | |
|----|----------------|-------------------------|--------------------------------|--------------------------------|-------|------|-----------------|--------|------|
| | | SiO ₂ | Al ₂ O ₃ | Fe ₂ O ₃ | CaO | MgO | SO ₃ | Alkali | CaO |
| 1 | PTs400 D0 | 22.55 | 4.75 | 4.7 | 65.04 | 1.73 | 0.21 | 0.62 | 0.16 |
| 2 | PTs400 D20 | 22.1 | 5.0 | 9.0 | 64.0 | 0.92 | 0.94 | 1.01 | 0.27 |
| 3 | PTs500 D0 | 21.75 | 4.91 | 4.62 | 66.2 | 1.73 | 0.21 | 0.62 | 0.16 |

The relative surfaces of the mentioned cements are 3000-3500 sm² /g located in the interval. The physico-mechanical properties of the cement stone and cement-sand mixture with the additives being studied in these cements were determined. GOST 310.1-76 of

specified cements " Tsementy. Clinical method. Obshchie pologenia " and GOST 310.4-81 " Cementy " . "Metody opredeleniya predela prochnosti pri izgibe i sjatii " [4] determined according to physical and mechanical properties are presented in Table 3.

Table 3.
Physical and mechanical parameters of cements

| Physical and mechanical properties | Type of cement | | |
|---|----------------|-------------|-------------|
| | 1 | 2 | 3 |
| Actual density, g/cm ³ | 3.1 | 3.1 | 3.1 |
| Bulk density, kg/m ³ | 1.3 | 1.3 | 1.3 |
| 1. Standard density, % | 28,0 | 27.0 | 25.0 |
| 2. Joining periods, hours - min. | | | |
| - the beginning | 1 - 45 | 2-15 | 2 - 55 |
| - ending | 4-5 0 _ | 4-5 5 _ | 6- 1 0 |
| 3. Fineness, % | 6.0 | 8,0 | 8.2 |
| 4. Strength limit on the 28th day, MPa: | | | |
| - in compression | 20.0 _ | 19,3 _ | 18.0 _ |
| - in bending | 7.1 | 6,4 _ | 6.5 _ |
| Uniformity of volume change | At one time | At one time | At one time |

Samples made of cement-sand mixture in 20x20x20 mm cubes, dried at a temperature of 105°C until a constant mass is formed GOST

310.4-81 "Tsementy". Methody opredelenia predela prochnosti pri izgibe i sjatii was determined according to " [5].

Table 4

Effect of JKS-1 malien copolymers on setting time of cement paste

| No | Types of attachment | The composition of additives relative to the mass of cement, % | Setting time of cement sample, hour-min. | |
|----|----------------------------------|--|--|--|
| | | | Kazakhstan M500+ | Oxangarancement M400 D0 |
| 1 | An unsupplemented control sample | 0 | - start 3 ⁴⁰ - end at 5 ⁰⁰ | - start at 4 ⁰⁰ - end at 6 ⁰⁰ |
| 2 | JKS-1 | 0.2 | - start at 3 ⁰⁰ - end 4 ⁴⁵ | - start 3 ²⁰ - end at 5 ³⁰ |
| 3 | JKS-1 | 0.4 | - start 2 ⁵⁰ - end 5 ¹⁵ | - start at 3 ⁰⁰ - end at 5 ⁰⁰ |
| 4 | JKS-1 | 0.6 | - start 2 ³⁰ - end at 4 ⁰⁰ | - start at 3 ⁰⁰ - end 4 ³⁰ |
| 5 | JKS-1 | 0.8 | - start at 3 ⁰⁰ - end at 5 ³⁰ | - start 3 ³⁰ - end at 6 ⁰⁰ |
| | JKS-1 | 1.0 | - start 3 ²⁰ - end at 5 ⁰⁰ | - start 3 ³⁰ - end 5 ⁵⁰ |

The addition of JKS-1 malien copolymer chemical additive to concrete mixes significantly changes their properties. JKS-1 increases the mobility of the cement mixture with malien copolymer, improves the properties of convenient placement, reduces the water requirement, etc.

The introduction of JKS-1 malien copolymer reduces the ratio of water and cement, the reduction of water consumption leads to an increase in concrete strength characteristics, all of which opens up the possibilities of obtaining high-strength concrete. Such aspects have a positive effect on the long service life of concrete, that is, on its durability.

The results of studies conducted at Tashkent University of Architecture and Construction "Construction Materials"

scientific research laboratory to determine the composition of mixtures with JKS-1 maleic copolymer additives showed that JKS-1 additive has the best operational properties.

Experimental studies were carried out in Tashkent University of Architecture and Construction "Construction Materials" scientific-research laboratory in order to approve the obtained results, to study the effect of JKS-1 maleic copolymer chemical additive on the physical and mechanical properties of cement compositions. All the researches were carried out according to the Interstate standard GOST 30459-2008 "Dobavki dlya betonov i stroitelynx rastrovov. Opreделение i otsenka effektivnosti" was performed in accordance with the requirements [6].

5 – table.

Dependence of the compressive strength of the cementitious composition on the amount of JKS-1 malien copolymer

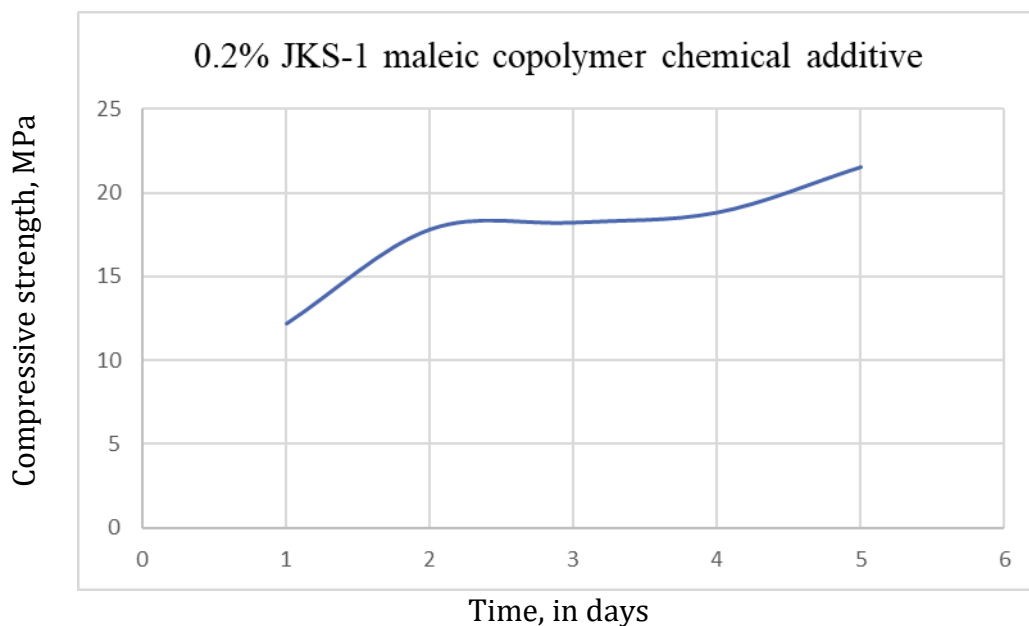
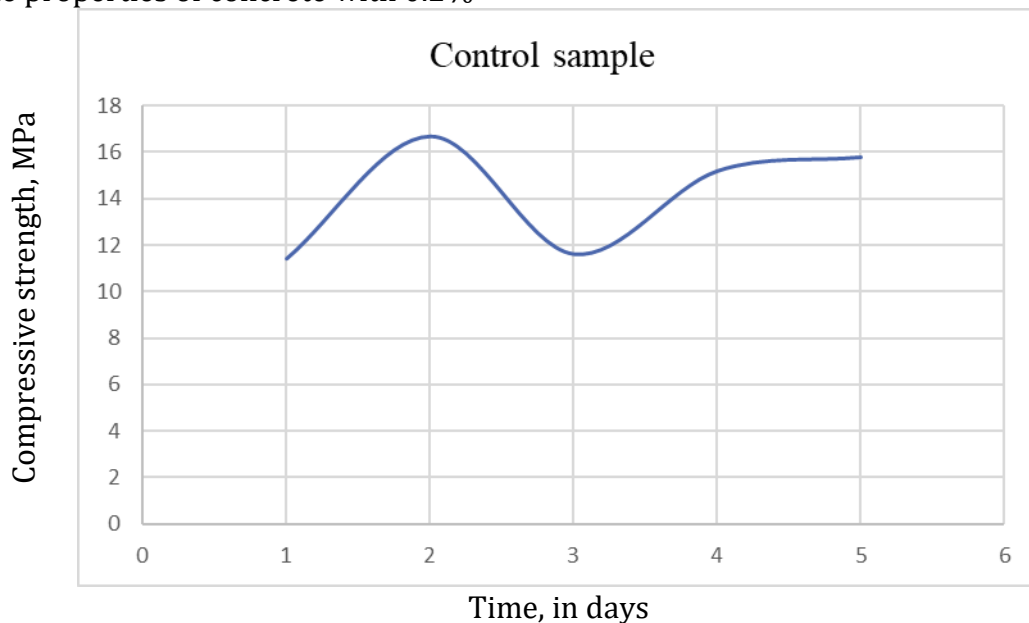
| t/r | the cement mass relatively JK S-1, in % | Compressive strength of cementitious composition (MPa) in days | | | | |
|-----|---|--|------|------|------|------|
| | | 1 | 3 | 7 | 14 | 28 |
| 1 | An unsupplemented control sample | 11.4 | 16.7 | 11.6 | 15.2 | 15.8 |
| 2 | 0.2 | 12.2 | 17.8 | 18.2 | 18.8 | 21.5 |
| 3 | 0.4 | 10.2 | 17.2 | 17.8 | 18.3 | 19.5 |
| 4 | 0,6 | 11.2 | 16.5 | 17.2 | 18.2 | 19.2 |
| 5 | 0,8 | 10.5 | 16.5 | 17.5 | 18.2 | 19.0 |

| | | | | | | |
|---|-----|------|------|------|------|------|
| 6 | 1.0 | 11.5 | 14.5 | 16.3 | 17.8 | 18.5 |
|---|-----|------|------|------|------|------|

Based on the results of the analysis of the experimental studies conducted on the study of the rheological properties of the cement mixture, the following was established: the best results were observed in the mixture with 0.2% amount of additives.

Based on the analysis of the conducted studies, it was established that the strength of the cement mixture increased by 15-20% compared to the control composition, and the water absorption decreased by 12-15%. It was found that the properties of concrete with 0.2%

JKS-1 addition are higher than those of concrete with 0.4, 0.6, 1.0% JKS-1 addition. Accordingly, JKS-1 maleic copolymers increase the strength of concrete during the entire period of hardening. However, the greatest increase in strength was observed in the first three days. In this case, the highest strength is provided when JKS-1 additive is added in the amount of 0.2%. For 14 days, the compressive strength reaches 35% compared to the design strength of concrete [7].



1 without suffix; 2- 0.2% JKS-1; 3- 0.4% JKS-1; 4 -0.6% JKS-1; 5 - 0.8% JKS-1; 6 - compressive

strength of the cement composition based on 1.0% JKS-1 malien copolymers .

Thus, according to the results of the conducted research, it was found that the best effect on the physical and mechanical properties of the cement composition can be achieved when adding JKS-1 malien copolymer chemical additive in the amount of 0.2 % by mass of portland cement.

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