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THE PERFORMANCE OF CHEMICAL ADDITIVES AND THE EFFECT ON THE PROPERTIES OF CONCRETE

Abstract: In modern concrete technology, chemical additives are the same an indispensable component of the concrete mixture, as a binder, aggregates and water. As practice has shown, the use of additives allows you to obtain a tangible technical and economic effect and increase the durability of concrete structures and engineering structures erected both from precast and monolithic concrete.

Key words: Concrete, chemical additives, structure, superplasticizer, cement, reinforced concrete.

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Introduction

The development of the construction industry in the last decade has been carried out under the sign of ever-increasing requirements for the rational and efficient use of raw materials and energy resources. This affects, in principle, the development of all branches of the building materials industry, and, first of all, the production of prefabricated and monolithic concrete and reinforced concrete structures. A practical solution to the problem of effective use of raw materials and energy resources in the production of dry and ready-made mortar and concrete mixtures, concrete and reinforced concrete, both prefabricated and monolithic, is fully possible only with a wide and comprehensive use of chemical additives.

Materials and methods

The problem of using additives for modifying concrete is multifaceted. In world practice, there is currently no unified classification of additives to cements and concretes. Different countries have

developed their own classification schemes. These schemes are based on the authors' desire to facilitate the correct choice of additives for concrete or mortars in accordance with their purpose.

Chemical additives, being one of the simplest and most accessible technological methods for improving concrete properties, can significantly reduce the level of costs per unit of production, improve the quality and efficiency of a large range of reinforced concrete structures, and increase the service life of both structures and buildings and structures in general. Therefore, the use of chemical additives in concrete technology in world practice is given great attention.

The effectiveness of the additives is determined by comparing the quality indicators of concrete mixtures, concretes of the control and basic compositions, with the exception of stabilizing, water-retaining additives and additives that increase the protective properties of concrete in relation to steel reinforcement. The effectiveness of these additives is

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determined only on concretes of the basic composition.

The optimal dosage of the additive is the minimum amount of the additive, when introduced into the concrete composition, the maximum effect of the action is achieved according to the efficiency criteria in accordance with GOST 24211.

Of the additives to concrete that have found the most widespread use in the production of concrete and reinforced concrete, plasticizing additives are in the first place. This is explained by the high efficiency of this type of additives, the absence of a negative effect on concrete and reinforcement, as well as availability and low cost. The greatest use of this type of additives falls on lignosulfonates - waste from the pulp and paper industry.

In the manufacture of reinforced concrete structures, they strive to obtain a workable mixture with minimal consumption of cement and water-cement ratio. This is due to the need to obtain economical concrete compositions of the required strength. The solution to this problem is fully possible only with the use of chemical additives that regulate the rheological properties of the concrete mixture.

The additives that regulate the rheological properties of concrete and mortar mixtures are mostly surfactants. A distinctive feature of surfactants is their high physicochemical activity at the interface in dispersed systems.

In accordance with the classification of additives in accordance with GOST 24211, superplasticizers belong to additives that regulate the properties of concrete mixtures, and in the group of plasticizing additives they occupy the first place. This is due to the

extremely high effect of liquefying the concrete mixture without reducing the strength of the concrete at all times of the test.

Superplasticizers appeared in the early 70s as a result of research by Japanese and German scientists. The main idea of creating such additives was to obtain concrete mixtures that could be placed in molds without using mechanical influences at all, or using them with a sharp decrease in the level of intensity of such influences.

Results

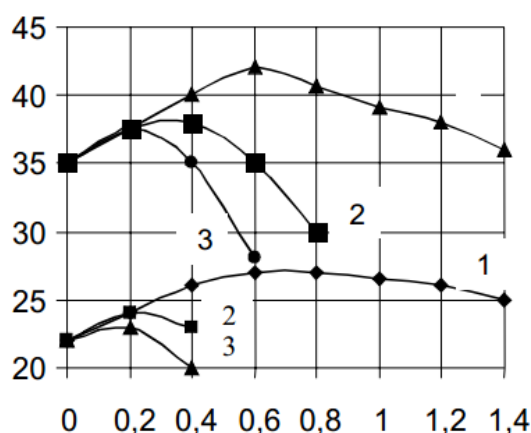
The mechanism of action of superplasticizers is still not completely clear today, but, nevertheless, the following facts can be considered established:

- superplasticizer molecules reduce the surface tension at the liquid-solid interface, while most surfactants reduce the surface tension at the gas-liquid interface. This circumstance is precisely due to the reduced air entrainment into the concrete mixture in the presence of superplasticizers;

- superplasticizer molecules have a dispersing effect on binder particles. As a result, the proportion of fine fractions in the presence of superplasticizers doubles, which increases the cementitious properties of the cement;

- the duration of the plasticizing action of superplasticizers is much shorter than that of conventional surfactants, which is associated with the structural features of the superplasticizers molecules and the value of their molecular weight;

- The additives of many superplasticizers have less effect on the rate of cement hydration compared to conventional surfactants.



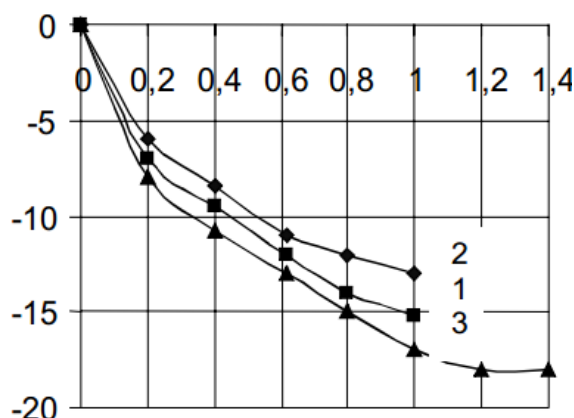
1-graph. Effect of dosage plasticizers for concrete strength

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2-graph. Influence of dosage of plasticizers on the water-reducing effect

Discussion

Influencing the processes of structure formation, especially at the initial (coagulation) stage, superplasticizers change the rheological properties of the cement system, help to reduce its water demand, which is further reflected in the parameters of the crystallization structure.

Thus, based on the available facts, it can be assumed that the mechanism of action of superplasticizers consists in the physical adsorption of macromolecules on the active centers of the binder, leading to a decrease in the internal friction of particles of the solid phase, as well as its dispersion. Subsequently, as a result of the appearance and

accumulation of calcium hydroxide in the system, a chemical interaction of the functional groups of superplasticizers with calcium hydroxide occurs, leading to the neutralization of molecules and their removal from the surface of cement particles.

Conclusion

Due to these features, superplasticizers of the type plasticizers are more effective, which is expressed in relatively low optimal dosages, low sensitivity to the type and composition of cement, in the long-term preservation of the initial consistency by concrete mixtures and in their increased cohesion of non-delamination.

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