Educator Insights: A Journal of Teaching Theory and Practice
Volume 01, Issue 06, June 2025
brightmindpublishing.com
ISSN (E): 3061-6964

EFFECT OF CHEMICAL ADDITIVES THAT SLOW THE SOLIDIZING TIME ON THE PROPERTIES OF PORTLAND CEMENT

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Abstract
In this article was studied the physical and mechanical properties of concrete with superplasticizers of Sikament RMC-519 and Sika Retarder, as well as the results of laboratory studies were given in the form of the table and graphs.

Keywords: Superplasticizer, chemical additive, strength, Portland cement, surfactant, water/cement ratio.

Introduction

The use of additives to change the properties of concrete is multifaceted. In world practice, there is no single classification of additives for cement and concrete. Classification schemes have been developed in different countries. These schemes are based on the desire of the authors to help in choosing the right additives for concrete in accordance with their goals.

When applied to a concrete mix, the superplasticizers “Sikament RMC-519” and “Sika Retarder” slow down its hardening, prevent the concrete mix from being poured and stratified before it is delivered to the construction site, and slow down the hydration process. “Sikament RMC-519” and “Sika Retarder” are considered high-quality superplasticizers and are effective in the production of concrete in hot climates. The use of superplasticizers “Sikament RMC-519” and “Sika Retarder” allows you to reduce the water-cement ratio of the concrete mix, increase the workability of concrete, and reduce the porosity of concrete. Reducing the water-cement ratio in concrete mixtures is relevant, because if more water is added to the concrete mixture than the norm, the more pores there will be in the structure of hardened concrete. These pores reduce the strength and frost resistance of concrete.

The main constituent minerals of cement and the mechanism of its hydration remain a matter of serious debate and resolution of issues. In this regard, it is necessary to first consider the reactions of clinker components with water, and then directly relate the complex process of the newly formed compounds to the main phase of alite cement in clinker, which is present in the form of a solid solution, containing a small amount of MgO, Al_2O_3, CrO_3, TiO_2, etc.

Depending on the ambient temperature and the concentration of calcium hydroxide in the liquid phase, they form calcium hydrosilicates of various compositions when interacting with water.

In the initial stage, primary hydrosilicates are formed, followed by secondary and tertiary hydrosilicates. First, an increase in the rate of heat release is observed, then an induction period occurs within 15-25 minutes of its occurrence. In the second stage, calcium hydrosilicates of different compositions are formed, the reaction rate is very low - the induction period. It can last for several hours. It is assumed that if the first two stages are affected by the addition, then the subsequent hydration will also be affected. In the third stage, the reaction proceeds actively, reaching a maximum speed at the end of the stage. In the fourth stage, the rate of heat release gradually decreases, and hydration continues. In the fifth stage, hydration products are formed in small quantities, and the stage is concentrated by diffusion processes.

In this experiment, we used Okhangaron PC400D20 Portland cement and Bekabad ShPC400 slag Portland cement. The chemical composition of Portland cement is given in Table 1 below.

Table 1. Chemical composition of Portland cement

Naming	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	R_2O
Portland cement	21,55	4,96	3,91	64,47	2,76	0,96	1,38

Table 2. Properties of Portland cements used in scientific research

№	Indicator	Unit of measurement	ПЦ400Д20	ШПЦ400
1	Normal thickness	%	27	27
2	Start of solidification time	min	127	122
3	End of solidification time	min	360	360

In our experiment, we added 27% water to PC400D20 Portland cement and Bekabad ShPC400 slag Portland cement. The cement is gradually mixed with the added water using a spatula. The mixture is first slowly and then quickly crushed with a spatula and mixed for 5 minutes.

A truncated cone ring lubricated with machine oil is placed on a glass plate and filled with the prepared cement mixture. The cement paste is compacted by tapping the glass plate on the table 5-6 times. The excess cement paste is scraped off with a wet knife.

The cement mixture placed in the ring on the glass plate is placed on the iron bed of the Vika instrument, while the sliding steel rod should fall into the center of the cement paste in the ring. Then, the lower end of the pestle is brought into contact with the surface of the cement mixture and the screw is quickly released.

A load with a total mass of 300 grams (rod and pestle) begins to sink into the cement paste in a free state. 30 seconds after the screw is loosened, the degree of immersion of the pestle in the cement paste is determined from the scale (the scale must be adjusted to "0" before testing). In our experiment, when we added 27% water, the normal thickness was 7 mm for PC400D20 Portland cement, and 6.5 mm for PC400 slag Portland cement.

Figure 1. Determining the normal density of Portland cement.

To determine the spreadability of cement, 400 grams of cement is weighed on a scale and placed in a round-bottomed tin pan with a depth of 100 mm. The cement surface is leveled and a recess is made in the middle with a steel spatula for adding

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brightmindpublishing.com
ISSN (E): 3061-6964

water. The amount of water is taken as 25-30% of the cement mass. In our experiment, we added 27% water to PC400D20 Portland cement and ShPC400 slag Portland cement. The cement is gradually mixed with the added water using a spatula. The mixture is mixed for 5 minutes by first slowly and then quickly with a spatula. The mixture is placed in a viscometer measuring device, when we lift the viscometer measuring device, the mixture spread to 7 cm.

Figure 2. Viscometer measuring device

Figure 2. Viscometer measuring device

We determined the spreadability using a viscometer by adding 0.5-1-1.5-2% of the superplasticizer "Sikament RMC-519" to the concrete mixture. The spreadability was 7 cm at 0.5%, 8 cm at 1%, 10 cm at 1.5%, and 10.5 cm when adding 2%. When we added the superplasticizer "Sika Retarder", the spreadability was 6 cm at 0.5%, 7 cm at 1%, 8 cm at 1.5%, and 9 cm when adding 2%.

When adding the superplasticizer "Sikament RMC-519" to 0.5-1-1.5-2% in slag Portland cement, the spread was 6.5 cm at 0.5%, 7.5 cm at 1%, 8 cm at 1.5%, and 10.4 cm at 2%. When adding the superplasticizer "Sika Retarder", the spreadability was 5 cm at 0.5%, 7.4 cm at 1%, 7.8 cm at 1.5%, and 9 cm at 2%.

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