

## PROSPECTS FOR THE USE OF FLOTATION WASTE FROM THE “KHANDIZA” FACTORY IN THE CEMENT INDUSTRY

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**Abstract:** This article presents the results of research on the use of flotation waste from the “Khandiza” concentrator plant as an additive to Portland cement. For this purpose, the composition of flotation waste was determined and its effect on strength was studied when adding up to 10%.

**Keywords:** Cement, clinker, flotation waste from the “Khandiza” concentrator, bending strength, compressive strength.

**Introduction:** Today, due to the development of the construction industry and the increase in construction volumes, the need for construction products, especially cement, is increasing. The high energy intensity of cement production requires efficient use of the product produced. Therefore, by adding active and mineral additives to the finished clinker, its volume increases. In this work, the influence of flotation waste from the “Khandiza” concentrator plant as an additive to clinker on the overall strength and kinetics of hardening processes was studied. To do this, various literature sources were first analyzed.

In the article, the authors discuss the issues of reducing the clinker content of cement and reducing energy costs in its production. It has been established that by jointly grinding active and inert mineral additives with cement clinker, it is possible to obtain a highly active composite cement with a reduced clinker content. The article models the dependence of cement strength on various factors and presents optimal cementitious composites [1].

In the following article, the authors described the practical properties of composite cements, environmental benefits, and the importance of reducing specific CO<sub>2</sub> emissions in the production process when producing many building materials. The study shows that the production of cement with several main components depends on the availability of suitable alternative raw materials, specific production conditions in cement plants and construction methods. According to the authors, composite cements not only help optimize production from an environmental point of view, but can also provide technical advantages such as low heat of hydration, high chemical resistance and good workability. To control the quality of composite cements, the same requirements apply to Portland cement [2].

As a result of the following studies, it was found that the use of quartz additive leads to a slight increase (up to 26%) in the water requirement of cement paste. The time for the onset of setting of cement paste with quartz additive gradually decreases with increasing its content (from 270 minutes to 140 minutes). The end of setting time decreases slightly (from 365 minutes to 325 minutes). In general, setting times comply with regulatory requirements [3].

In order to ensure the effective development of the cement industry in the production of mixed cements in the world, much attention is paid to the elimination of industrial waste. In another peer-reviewed article, a group of authors briefly discussed recent advances in the field of additive cements. An intermittent granulometric composition of cements with additives based on the theory of close packing is proposed to obtain a high initial packing density of the components of hardening cement. It was then found that the hydration efficiency of cement and active mineral admixtures increases when the active mineral admixtures are selected taking into account the amount of fine, medium and coarse fractions

of mixed cement, high/low active and cement clinker or inert admixtures. In accordance with the recommended principles of optimal granulometric composition, high-quality cement with additives containing only 25% clinker was obtained. A cement mixture with a discontinuous granulometric composition has a very high stability of properties due to its homogeneous and dense microstructure, and also helps to reduce CO<sub>2</sub> emissions, save natural resources and energy [4].

The following article analyzes the availability and use of secondary resources suitable for use in cement production instead of natural raw materials and fuels. Information is provided on changes in the direction of production of cements with additives. An important reason for reducing the use of waste is the imperfection of the existing regulatory framework, and proposals have been made to change the situation [5].

### Experimental part

First, the composition of flotation waste was studied by X-ray fluorescence analysis, the results of which are presented in Table. 1.

Table. 1

#### Composition of flotation waste from the “Khandiza” processing plant

Composition	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	SO <sub>3</sub>	Na <sub>2</sub> O	TiO <sub>2</sub>	MnO
Mass fraction, %	52,54	0,27	42,12	1,30	2,03	0,13	1,61	-	-

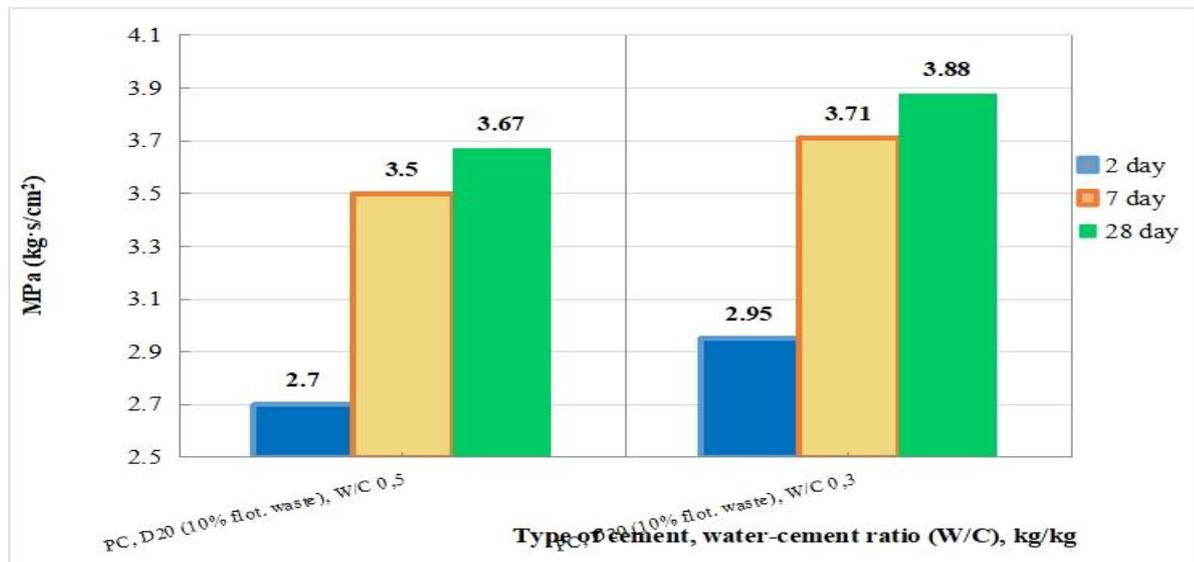
It has been established that the composition of flotation waste is as follows: quartz up to 53%, carbonates 3-4.5%, layered silicates up to 15%, iron compounds - 42%.

To add flotation tailings to Portland cement, 10% limestone and 10% flotation tailings were added to the clinker and ground together. From the resulting cement of the new composition, a mixture was prepared in the following order: 1350 g of polyfractional sand, 405 g of Portland cement of the new composition and 225 g of distilled water.

A sample of cement grade SEM II/A-I 32.5N with flotation waste from the Khondzhiza concentrator hardened 30 minutes slower than a sample of cement without an additive. The end of hardening also occurred on average after 30 minutes.

A sample of cement-based concrete with 10% Khonjiza flotation waste was prepared at a water-cement ratio of 0.5 and 0.3 and its flexural strength was determined (Fig. 1).

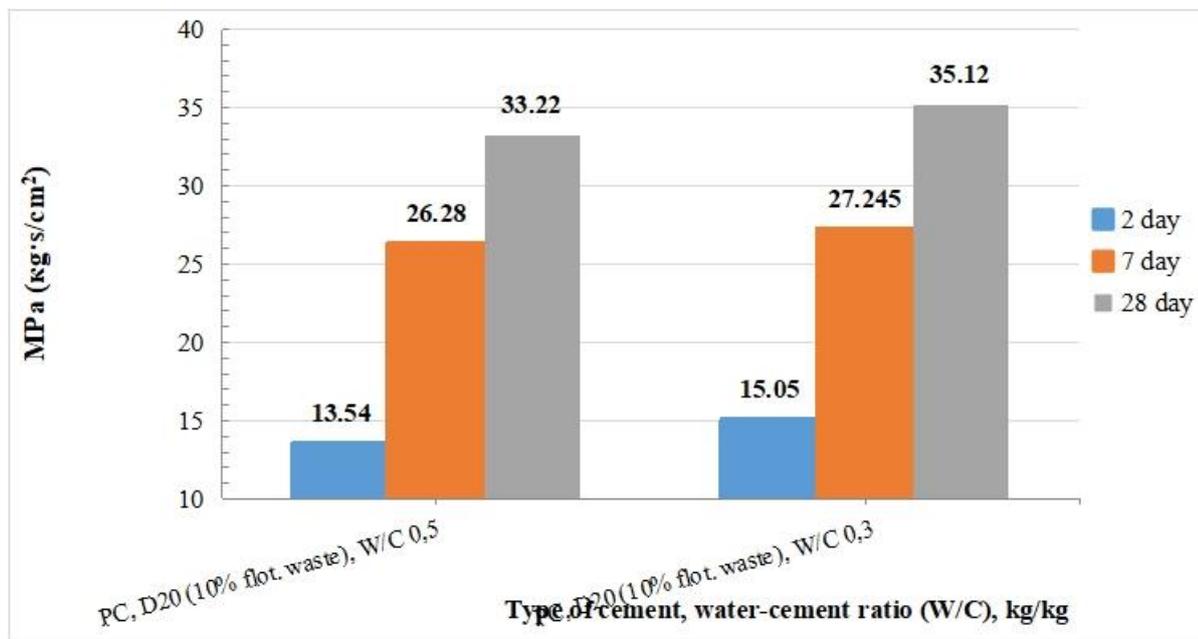
### The discussion of the results



**Figure 1. Flexural strength of concrete samples obtained at various water-cement ratios based on cement with the addition of 10% “Khanjiza” flotation waste**

The result shows that the flexural strength at 0.5 water-cement ratio is 2.7 MPa after 2 days, 3.5 MPa after 7 days, 3.67 MPa after 28 days, 2.95 MPa after 2 days at 0 water-cement ratio. 3, it was 3.71 MPa after 7 days. days and 3.88 MPa after 28 days. When flotation waste from the Khondzhiza processing plant was added to cement, the water demand of concrete decreased slightly due to the silicon oxide it contained.

The bending strength of a concrete sample prepared with a water-cement ratio of 0.5 and 0.3 based on cement with the addition of 10% Khondzhiza flotation waste was determined (Fig. 2).



**Figure 2. Compressive strength of concrete obtained with different water-cement ratio based on cement with 10% Khonjiza flotation waste**

As shown in Figure 2, 13.54 MPa after 2 days at 0.5 water-cement ratio, 26.28 MPa after 7 days, 33.22 MPa after 28 days, 15.05 MPa after 2 days at 0.3 water-cement ratio, it was 27.245 MPa after 7 days and 35.12 MPa after 28 days.

**Conclusions:** Flotation waste does not reduce the strength of cement-based concrete. The reason is that the microcrystals of silicon oxide in the flotation waste block the microcapillaries formed as a result of the hardening of the concrete mass and prevent the release of water, and the water participates in complete hydration. Another advantage of flotation waste dewatering is that no excess energy is required for grinding.

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