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LABORATORY RESEARCH OF HEAT TREATMENT CONCRETE SAMPLES HEATED AIR IN THE COLLECTOR SOLAR ENERGY

The experimental results of thermal treatment hot air hydro isolated samples of heavy concrete. Heated in the collector solar air rushed by a fan for laboratory chamber in which the samples were placed on a hard concrete. After stop the flow coolant in the chamber was thermoses cooling concrete. Compressive strength of samples defined under the age of five days (by heat treatment heated air for 3 and 6 h) and at the age of two days (by heat treatment heated air for 3 h).

***Keywords**: laboratory equipment, heat treatment, heated air, concrete samples, solar power.*

Introduction. The use of solar energy by heat treatment of concrete and concrete products enables energy savings in the process. However, the intensity and duration of incoming solar energy to the appropriate equipment is variable. Therefore, laboratory studies should consider different variants of these indicators.

Overview of the latest sources of research and publications. The book [1] shows the directions of the use solar energy for the production of concrete and concrete products. In [2] The features of heat exchange processes occurring in reinforced concrete structures in helio heat treatment, and the effect of these processes on the physical and mechanical properties of structures. In [3] a method of complex helio thermal treatment products from foamed concrete to landfills. In the patent [4] shows the principle of the solar collector designed for heat treatment of concrete and concrete products. In the patent [5], the method of using solar energy for thermal treatment of concrete and reinforced concrete products. Coolant - heated air in the collector solar energy. An additional source of heat - stove. Products during such of thermal treatment should be hydro isolated.

Selection of the unsolved problems of parts. Laboratory studies of the process of thermal treatment of concrete in hot air solar collector allow to establish the conditions under which the use of this method is effective.

Problem statement. Purpose of work - determine the ratio between the compressive strength of control samples with heavy concrete structure and investigated samples heat treatment which the heated air and then of thermoses cooling.

The basic material and results. Considered heat treatment of the samples heavy concrete investigated structure using air heated in the solar collector. Previous exposure to concrete samples of thermal treatment was 1 hour. The heated air in the collector for 3 and 6 h was directed by a fan for laboratory chamber, which was located hydro insulated concrete examples. The total period of stay in the samples chamber - 28 hours.

On the temperature regime of concrete that hardens affects heat release cement by hydration.

When heat treatment concrete samples heated in the collector solar air for 3 hours they increased temperature in the first experiment (Fig. 1) from 21,4 to 37,9ºC (Δt = 16,5ºC), and in the second experiment (Fig. 2) - from 22,3 to 41,2ºC (Δt = 18,9ºC).

As a result of the approximation of the experimental data (Fig. 1) an equation

$$y = 0{,}011x^3 - 0{,}366x^2 + 4{,}376x + 17{,}90. \quad (1)$$

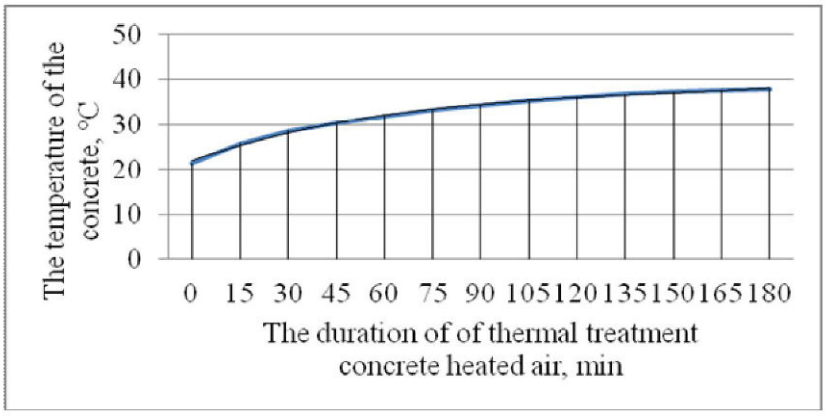

Fig. 1. Changing the temperature of concrete at its heat treatment in heated air solar collector (experiment 1)

As a result of the approximation of the experimental data (Fig. 2) an equation

$$y = 0{,}012x^3 - 0{,}387x^2 + 4{,}643x + 18{,}25. \quad (2)$$

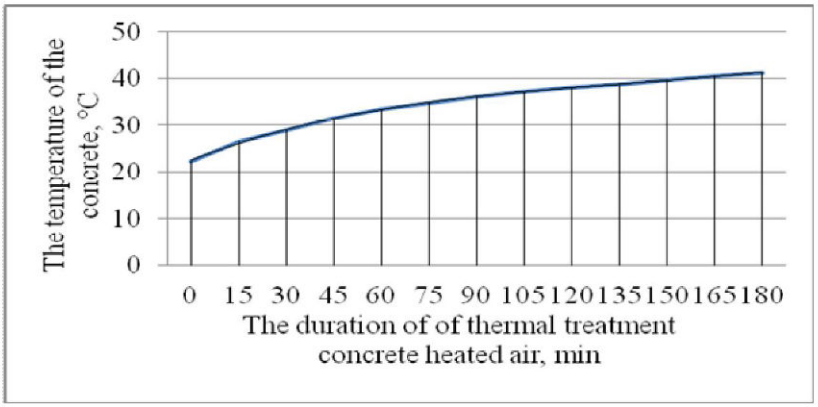

Fig. 2. Changing the temperature of concrete at its heat treatment in heated air solar collector (experiment 2)

In experiment 3 (Fig. 3), the temperature of the samples increased by heavy concrete 6 hours of thermal treatment heated air from 20,1 to 48,4ºC (Δt = 28,3 ºC). As a result of the approximation of the experimental data an equation

$$y = 0{,}002x^3 - 0{,}156x^2 + 3{,}458x + 17{,}25. \quad (3)$$

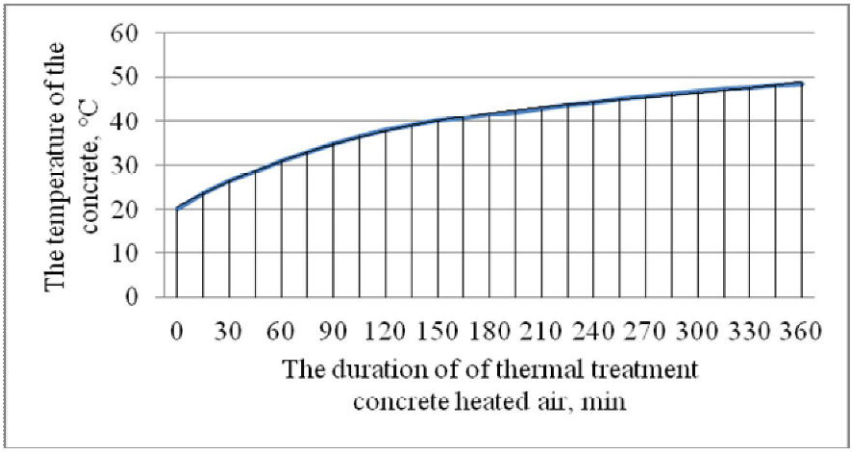

Fig. 3. Changing the temperature of concrete at its heat treatment in heated air solar collector (experiment 3)

Figure 4 shows the change in temperature of the heavy concrete investigated composition, heat treatment was carried out by a laboratory chamber air heated in the solar collector (experiments 1 - 3).

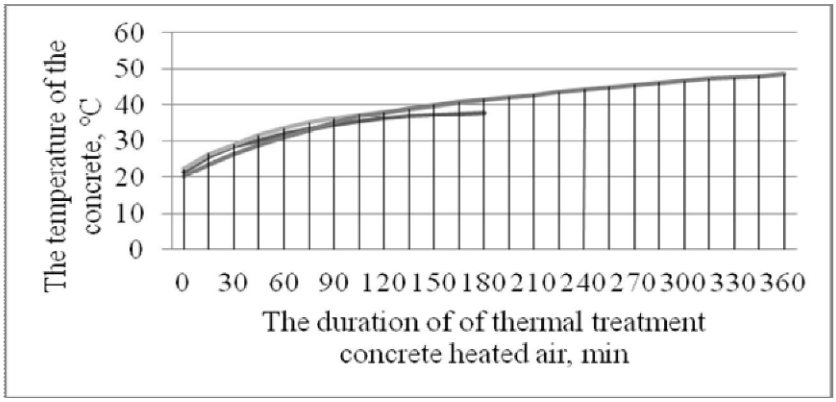

Fig. 4. Changing the temperature of concrete at its heat treatment in heated air solar collector (experiment 1-3)

Compressive strength samples of heavy concrete investigated structure at 2 days (experiment 1) greater than the corresponding strength of control samples, 35,7% (Fig. 6).

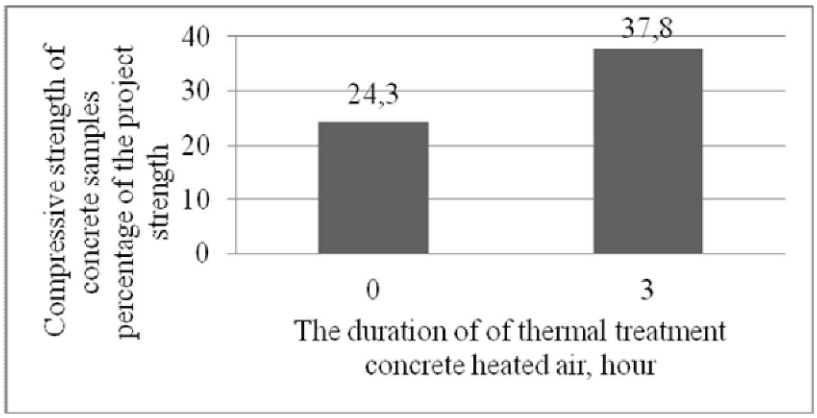

Fig. 5. Compression strength samples with heavy concrete at 2 days, the percentage of design strength (experiment 1)

Compression strength samples of heavy concrete structure investigated at 5 days (Experiments 3 and 4) greater than the corresponding strength of the control, in experiment 3 by 23,9% and in experiment 4 in 29,2% (Fig. 6).

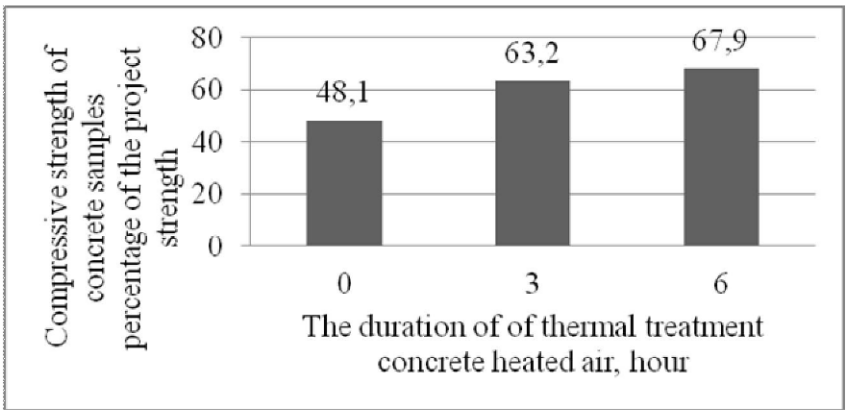

Fig. 6. Compression strength samples with heavy concrete at 5 days, the percentage of design strength (experiment 2, 3)

The difference between the compressive strength of concrete samples heat treatment which heated air was carried out for 3 and 6 h, relatively small (Fig. 6). This is explained by the following main factors:

- thermoses cooling of samples and the presence of the process of heat during cement hydration ensures that the temperature of the concrete samples after stop the flow air for some time is higher than the ambient temperature;

– after stripping concrete samples solidified under the same conditions of temperature for 4 days.

These experiments are an integral part of a series of experiments designed to study of the method of thermal treatment of concrete products, which prompted the source [5].

Conclusions. Heat treatment hydro isolated samples of heavy concrete structure investigated in heated air solar collector for 3 and 6 hours (with a further cooling of termosnomu which is accompanied by heat release due to hydration of cement) can accelerate the set concrete compressive strength (Fig. 5, 6).

If solar energy is not supplied to the collector, you must or use an additional source of heat (as suggested in the patent [5]), or to make heat treatment concrete by the heat which is released during cement hydration (patent [6]).

In next studies should develop recommendations on the conditions under which the use of the proposed method of thermal treatment of concrete products is appropriate.

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