HELIOTHERMO CONCRETE PROCESSING IN HOT CLIMATES

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Annotation: This article highlights the physical destructive processes in the initial period of hardening, as well as the physical and mechanical properties of concrete and the results of the experiment of hardening concrete in the summer. In addition, it is said that temperature fluctuations and air humidity adversely affect the formation of the structure of concrete, which in turn leads to a decrease in its strength.
Ключевые слова: destructive processes, plastic shrinkage, concrete care, water evaporation, water-dispersion composition, ambient temperature. hot and dry climate, concrete dehydration, concrete structure, cement hydration process, strength.

In the southern regions of the country, heat treatment is used to intensify the hardening of concrete. It is also used in the manufacture of products in open areas and landfills with high fuel consumption. At the same time, intense solar radiation for 6-7 months provides enough heat to be used to accelerate concrete hardening instead of traditional methods. It is essential that in addition to saving energy resources and ease of implementation of this technological redistribution, high quality of products is ensured, which is not always achieved by existing methods of heat treatment. In a number of research works, such a value of solar energy during the day should be in the range from 4 to 6 kWh / m2, which fully meets the requirement and has a stripping or tempering strength of concrete at one day of age.

Premature dehydration of concrete negatively affects its strength - it becomes porous, cracks appear, and water permeability sharply decreases. In this case, great attention must be paid to the selection of the components of the concrete mixture. Portland cement should be used and Portland slag cement and Portland pozzolanic cement are not recommended. For this, highly active, but low-shrinkage cements, chemical additives - hardening accelerators, as well as heat treatment methods are used. The method of heat treatment can be the most effective, since it allows not only to reduce the risk of dehydration, but also to obtain the necessary concrete strength in the shortest possible time. It should be borne in mind that after concrete acquires 70 ... 80% of the design strength, it does not require any special care in a dry and hot climate. Heat treatment of concrete and reinforced concrete products is one of the longest and most important processes in the technology of their production. Its essence lies in the fact that when the temperature rises to 80 - 100 ° C, the reaction rate of the hydration of binders increases.

В тех случаях, когда количество поступающей солнечной энергии оказывается less than these values, it is necessary to supply additional thermal energy to the products from duplicate heat sources,

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i.e. to pass to the combined solar thermal treatment of concrete (CHPT). Such types as steam, electricity, hot water, mineral oils, air, natural gas combustion products, etc. The transfer of heat to concrete with the help of such heat carriers can be carried out in two ways: by external action when it is suspended from the outside and by its formation inside the concrete itself [3.4.5.11.13.14]. In accordance with this, all the listed types of traditional heat carriers constitute a separate group, united by the fact that heat is transferred from them to concrete by a contact method. True, electrical energy, besides this, can generate heat inside the concrete, if the latter plays the role of resistance when current passes through it. The contact of the coolant with concrete occurs through a dividing wall, due to which, from the standpoint of heat transfer processes, it puts all the coolants under consideration in the same position from the point of view of their use in the CHP of concrete. In the process of heating, the modes are constructed in such a way as to minimize the energy consumption from duplicate sources. In this case, the saving of energy resources should also take into account the exotherm of the cement, which, when heated, proceeds quite intensively. When designing heating devices, one should strive to reduce heat losses to the environment both from the heater itself and from the parts of the mold and concrete boarding equipment heated by it. Theoretically, such losses lead to the fact that the efficiency of electric heating devices based on, for example, flat heating elements that transfer heat to concrete only by thermal conductivity and are not thermally insulated from the outside air, as a rule, exceeds 50%; for linear (round) under the same conditions, the efficiency is no more than 35%. However, in practice, these losses can be significantly reduced due to the creation of closed air layers, the use of thermal protection from materials with low thermal conductivity coefficients, the creation of heat-reflecting screens, etc. [5.7.9.11.13.14.15.19]. The studies were carried out on an experimental stand, which is an unshaded area with dimensions in plan 3x6 m, covered with expanded clay gravel 15 cm thick.Previously, one layer of film was laid on this site with a sand-gravel base, covered with expanded clay gravel, then expanded clay was covered with another layer films and asphalt concrete. At the edges of the experimental stand was tightly closed with concrete curbs, installed before backfilling with ceramic gravel. All this made it possible in the course of the experiments to maintain the expanded clay constantly in a dry state, to limit the convective heat exchange and, thereby, to ensure a high thermal insulation capacity of the stand in any period of the year (Fig. 1). In this series of experiments, a concrete mixture with W / C = 0.54 and O.K = 6-8 cm was used on Portland cement M 400 of the Kuvasay cement plant, quartz sand with Mk = 1.8 and dense gravel fr = 5-20 mm of the Aktash quarry of the Namangan region. The ready-made mixture at 9.30 a.m. was placed in previously prepared forms.

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Fig. 1 General view of the test bench

One of the techniques that to a large extent affect the efficiency of the device is the correct choice of electric heaters. The main requirement for such a choice should be the condition for ensuring uniform heating of products. This condition is met when the area of the heater surface in contact with the deck of the mold corresponds to the heated area of the bottom of the mold, i.e. there is the same filling factor for all types of heaters. Analysis of this condition shows that in this case flat electric heaters will have a certain advantage, having a smaller surface compared to, for example, round ones and at the same power they will have a higher heating temperature and lower heat losses. Equalization of the electrical parameters of various heaters makes it possible to select them for the CHPO on the basis of taking into account the technological factors of the work. These include, first of all, the method of transferring heat to concrete.

As you know, in a dry and hot climate, as a result of exposure to solar radiation, high temperature, low humidity and dry winds, mixing water necessary for cement hydration evaporates from freshly laid concrete, and as a result the concrete does not gain the required strength. Especially, the negative impact of hardening conditions in the summer season is carried out with concrete lining of channels with a thickness of 20-30 cm. One of the ways to solve this problem is to accelerate the hardening of concrete, since concrete can resist the negative effects of the hardening environment with a rapid build-up of strength. Acceleration of cement hydration processes can be achieved by increasing the fineness of cement grinding, introducing accelerating additives and plasticizers, and improving the technology for preparing a concrete mixture.

In ESSK-4 located in the village. Aktash, Namangan region, and studies were carried out to determine effective ways to accelerate the hydration of cement. As you know, during the preparation of a concrete mixture, immediately after the contact of cement with water, the latter penetrates into the micro-solutions of cement particles and cement dissolution begins. The higher the rate of mixing of cement with water, the more intensive its dissolution is. At the same time, the opposite process is going on - cement particles in the water begin to unite into floccules under the influence of attraction. The distribution of water between the flocculi and within them is uneven. As a result, adhesion of cement particles occurs, while these particles do not participate in the process of cement hydration [5.11.13.14.15].

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Table 1. The influence of chemical additives introduced into the concrete mixture on the rate of concrete strength gain.

№	Chemical additives	Strength of cubes of samples in MPa, days			
		1	3	7	28
1	SDB	2,9	5,6	7,5	10,1
2	S-3	3,1	6,2	8,1	10,4
3	No additive	2,8	5,3	7,2	10

As you can see from the table, when using chemical additives in a concrete mixture, the rate of concrete strength increases significantly. The use of chemical additives leads not only to a decrease in cement consumption, but also increases the density, water permeability and frost resistance of concrete (as a result of an increase in the volume of air entrainment, the volume of cement paste per unit of cement increases, which leads to a decrease in voids in concrete), which is very important in the preparation of hydraulic concretes ...

The main reason for the cessation of hardening of concrete mixtures when exposed to low temperatures is the freezing of water in them. It is known that the content of salts in water sharply reduces its freezing point. If, during the preparation process, a certain amount of dissolved salts is introduced into the concrete mixture, the hardening process will also proceed at temperatures below 00C. The use of antifreeze additives (sodium chloride in combination with calcium chloride, sodium nitrate, potash, etc.) in the amount of 3-16% of the mass of cement, providing hardening at low temperatures, allows you to transport the concrete mixture in non-insulated containers and lay it in the cold. When choosing the type of additive, the field of application of concretes with chemical additives and the existing restrictions are taken into account. The optimal amount of additives usually does not exceed 16% by weight of the cement. The mixture with antifreeze additives is placed in the structure and compacted in compliance with the general rules for laying concrete.

Table No. 2

The rate of concrete strength gain on Portland cements with antifreeze additives% of R28

Curing temperature, ^{0}C	Concrete hardening, days			
	7	14	**28**	**90**
Sodium nitrite				
-5	30	50	70	90
-10	20	35	55	70
-15	10	25	35	50
Sodium Chloride + Calcium Chloride				
-5	35	65	80	100
-10	25	35	45	70
-15	15	25	35	50
-20	10	15	20	40

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Preheating of the concrete mixture can also be used when concreting products in the first shift, if the maximum temperature level of heating the mixture corresponds to such a real amount of solar energy supplied during the day, which will not heat the concrete, but only correspond to the compensation of heat loss in environment [3.4.5.11.13.14.15].

The second important technological factor is the way the products are manufactured. The simplest interaction of solar and electric energy in the case of a CGETO of concrete is carried out with a bench technology for the manufacture of products. In this case, the mold can be equipped with almost any individual electric heaters that satisfy such requirements as non-scarcity, ease of manufacture, reliability of fastening and duration of operation without significant changes in its electrical parameters. In this design, each form is a separate thermal unit, which, although fixed at a certain place in the heliopolygon, has the advantage that, regardless of the product range, it provides for any of them the KGETO of concrete according to individual thermal conditions.

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