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Light-Weight Concrete Properties on Base Polymeric-Fiber-Waste Addition

Kuldashev Kh.
Is a teacher at Tashkent State Pedagogical University

Jamolov Sh.
Teacher of Samarkand State architectural and civil engineering institute

Abstract: *An analysis the effect of using fiber-waste materials as a fine aggregate a in a mixes are reported. Six different mixes were prepared and tested, which polymeric-fiber-waste was used as a sand from mass of quartz sand 15, 20 and 25%. in 6 consists.*

Investigated and test results showed, that incorporation fiber-waste into a mix increase flexural straight to 121% and 134%

Keywords: *polymeric-fiber-waste, expanded clay , aggregate, compressive and flexural straight, aggregates, light-weight concrete*

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1. Introduction.

Modern life now, to build and construction houses and other service house buildings are developed. Particularly, it can be reduce price of construction for heat insulating and energy-save houses and buildings from light-weight concrete in a places where are enough raw materials for it. Light-weight concrete and very light-weight concrete are main material in a part of building construction. This kind of material is calculated different type for using and standards. Day by day it is on the increase for building materials and products and quality of them.

There are new technology to get heat insulated concrete from waste and also used natural and synthetic aggregates like waste. Such as light weight aggregate is expanded clay, reserve of raw materials are in Djizak and Samarkand area. Expanded clay is getting from nature raw material swelling and roasting in $1000\text{-}1400^0$C temperature.

Expanded clay has a porosity structure, so heat isolation material and can be useful as a large aggregate in a heat insolate light-weight concrete. Expanded clay is ecological clean, fire-resistive, bio-resistant and chemical inertness product. Its apparent density is 300-600 kg/m^3, real density is 1,0 g/sm^3, porosity is 75-85%, water-permeability is 42-47%.

Also, reinforcing is main aspects in concrete products. Polymeric-fiber-waste is able for dispersion reinforcing in cement stone and concrete matrix, which influence of straight properties, manage of calculate light-weight concrete and develop it (picture 1). The concrete mixture is reinforcing with fiber-waste improve its plastic properties, decrease volume deformation and etc. Clearly, concrete mix during plastic condition the polymeric-fiber-waste keep from micro and macro-cracks under adhesion [1].

Fiber structure is generally known in micro and macro terms. On the micro level, a textile fiber is made of polymeric chains that are organized into three distinct phases: the oriented crystalline regions; the amorphous regions, also with preferential orientation along the fiber axis which contain tie molecules connecting crystallites; and the highly extended noncrystalline molecules, which are called the interfibrillar phase. The degree of orientation and degree of crystallinity are two important structural characteristics of a textile fiber. The first describes how well the polymer chains within a fiber align along the fiber axis, while the second is concerned with the three-dimensional order of the polymer chains. Both are influenced by manufacturing conditions, and to some extent can be controlled.

1-picture. Polymeric-fiber-waste

2. Experiments. Materials.

The experiments did in the laboratory №5 of Samarkand state civil engineering and architecture institute in Uzbekistan. (Cement-concrete testing center) For the experiments were used Portland cement of “Qizilqumcement” (CEM I 32.5N) 40 MPa similar to DRAFT INTERNATIONAL STANDARD ISO/DIS 679, quarts sand ISO (size of sand 0.16-2 mm) from career of Samarkand region and polymeric-fiber-waste sand delivered from Navoi region. It consists of textile fiber are its surface structure and cross-sectional size and shape. Different types of fibers differ greatly on the macro level. For example, polyester and nylon fibers usually have smooth surface and round cross-sectional structures, while natural fibers such as cotton and wool have rough surface structures and irregular cross-sectional shapes and 350 kg/m^3 density of expanded clay coarse aggregate. During experiments were using press machine and numerical technology according standards.

There are characteristics and volume of concrete samples for tests in the given table.

№	Name of samples, sm	The age of concrete (day) and amount of samples (unit)				Total, unit	Main purpose of research
		7	28	60	90		
1	Cubes (expanded clay, quartz sand) 10x10x10 sm					12	Tests of light-weight concrete cube durability on base expanded clay and quartz
2	Cubes (expanded clay, quartz sand, fiber) 10x10x10 sm					12	Tests of light -weight concrete durability on base fiber

3	Prism (expanded clay, quartz sand) 4x4x16 sm	12	Tests of light -weight concrete prism durability on base expanded clay and quartz
4	Prism (expanded clay, quartz sand, fiber) 4x4x16 sm	12	Tests of light -weight concrete prism durability on base fiber
5	Prism beam (expanded clay, quartz sand) 4x4x16 sm	6	Test of cement's durability

It has studied main properties of need components (cement, expanded clay, quartz sand, fiber) for preparing concrete mix. Also get mass every component to make B5 class concrete for first consist.

Light-weight concrete consist is calculate like this:

First consist (control) for 1m^3: Cement-300 kg, quarts sand-300 kg, expanded clay coarse aggregate-345 kg, water-245 l. Components are given in C:S: fiber=1:1:0,9, there under W/C=215/300=0,72 (water-cement ratio). Volume weight of concrete is ρ=1190 kg/m^3.

Second one (introduce 20% fiber of mass of quartz sand): Cement-300 kg, quarts sand-240 kg expanded clay coarse aggregate-345 kg, water-245 l, fiber -60 kg. Components are given in C:S: fiber=1:1:0,9, there under W/C=245/300=0,72 (water-cement ratio). Volume weight of concrete is ρ=1190 kg/m^3.

Third consist (introduce 15% fiber and expanded clay 25% of mass of quartz sand): Cement-300 kg, quarts sand-225 kg, expanded clay coarse aggregate-345 kg, water-245 l, fiber -75 kg. Components are given in C:S: fiber=1:1:0,9, there under W/C=245/300=0,72 (water-cement ratio). Volume weight of concrete is ρ=1190 kg/m^3.

Fourth consist (introduce 25% fiber and expanded clay 33% of mass of quartz sand): Cement-300 kg, quarts sand-201 kg, expanded clay coarse aggregate-345 kg, water-245 l, fiber -99 kg. Components are given in C:S: fiber=1:1:0,9, there under W/C=245/300=0,72 (water-cement ratio). Volume weight of concrete is ρ=1190kg/m^3.

Preparation of mixture were executed on standard DRAFT INTERNATIONAL STANDARD ISO/DIS 679, using automatic mixer (Mixmatic). Mixture was compressed down on vibratory table in plastic forms of size 10x10x10 sm cube samples. Preparing concrete mix has density 870-900 kg/m^3 after 28-90 days hardening.

The experiments did in the accreditation laboratory № 5 of Samarkand state civil engineering and architecture institute in Uzbekistan. Samples are tested in 7, 28, 60- and 90-days ages. Compressive toughness of concrete cubes are checking in MS-50 hydraulic press.

3. Results and discussions.

Tested results were shown (look tab.1).

Table 1. Results of samples on toughness of compressive

2mixes	Бетоннинг сиқилишдаги мустаҳкамликлари							
	7 days		28 days		60 days		90 days	
	R_b,MPa	%	R_b,MPa	%	R_b,MPa	%	R_b,MPa	%
1-consist	2,9	100	3,9	100	4,3	100	4,9	100
2- consist	3,3	114	4,9	130	6,3	133	6.3	133
3- consist	3,4	116	4,2	113	6,7	139	6.7	139
4- consist	3,5	121	4,9	121	5,9	127	5,9	127

Note: there are fiber from mass of quartz sand 15, 20 and 25%.in 4 consists.

Tested results were shown, that introduce the fiber bring to increase of boundary straight of light-weight concrete at W/C=0.72 in age 90 days at compressive to 39%. Also, consist of 15% fiber sand's toughness in 28 and 90 days are 6,3 and 6,7 MPa. Compare than control mix increase of toughness at 20% and 25 % in a 28- and 90-days ages. So, consist of 15% fiber's toughness in 28 and 90 days are increase of toughness at 21-30% and 33-39 % in a 28- and 90-days ages.

4. Summary and conclusions:

One more quality of fiber extending on length structure crystal, under splitting which are formed grain-needle forms. Needle forms of grain of fiber apply as a micro-reinforcing [2]. The crystals of fiber, having needle forms the surface which, possessing certain roughness forms around itself if creative thinking, certain associates from surrounding materials, forming matrix of the main composition of cement compositions. Reducing thereby degree of their mobility independently of one another. So noticeably decrease the processes of the deforming the shrinkage, for instance when repeating over and over again to cement compositions (the concrete at usages). Possessing good adsorptive characteristic, it reduces tap-forming. Mircro-reinforcing characteristic of fiber and high adhesion to surface provides increasing straight factors and value of toughness of the traction it with surface [3, 4, 5, 6].

1. Using fiber as a filler with fineness modulus M=1,0 increase straight of heat insulate light weight concrete up 35-39%. It can be wide using of light weight concrete and very light weight concrete in construction.

2. Fiber structure in reinforced molded components is directly related to the process. Fiber length degradation takes place mostly in the plasticizing unit but the fiber length distribution is not yet considered in our modeling. Fiber concentration can be considered as constant in first approximation even though, in the plaque with ribs, we measured some important fluctuations inside the part. Therefore the evolution of fiber concentration may have an influence on the evolution of fiber orientation during the process. Fiber orientation varies a lot throughout the part, especially in the thickness. A core region with fibers transverse to the flow direction is almost always created in the gate region, because of high elongation rates. Near the surfaces, fibers are predominantly oriented in the flow direction.

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