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Original Research Article

Processing of modified fiber concrete composition

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ABSTRACT
The possibility of obtaining a natural mineral-active supplement containing SiO_2 of ultra pomegranate on the basis of Umbaki quartz sand, located in the territory of the Republic of Azerbaijan, was determined experimentally. It was determined that when this type of additive is used up to 8-10% of the cement consumption, the compressive strength limit of cement-sand systems increases by 7.9%, the flexural strength limit by 4.35%, and the average density increases by 1.46%. With the complex use of ultra pomegranate SiO_2-containing mineral additive, superplasticizing and hyperplasticizing additives, these indicators increase even more. Heavy concrete and fiber concrete compositions modified by the application of such complex additives were developed, and mathematical models of the compressive strength limit parameter were established using the mathematical statistical analysis method of the experiments. Fiber concrete composition is optimized. Modified heavy concrete composition with a compressive strength limit of 43 MPa, an average density of 2379 kg/m^3, a compressive strength limit of 49.70 MPa, a fiber concrete composition with SiO_2-containing natural mineral admixture and a superplasticizer additive of pomegranate with an average density of 2403 kg/m^3, a compressive strength limit of 59 MPa, average density of 2475 kg/m^3, fiber concrete composition with SiO_2-containing natural mineral additive HP 777 hyperplasticizer was processed.

1. Introduction

Relevance: Concrete and reinforced concrete products and structures are used in the construction and installation of all types of objects. This is due to the variety of components used in the preparation of the concrete mixture and the presence of local production, the possibility of obtaining required strength index, wide operational index (abrasion resistance, crack resistance, frost resistance, low water resistance, chemical resistance, radioactive resistance, etc.) and yeast. that the value is partially low. Achieving concrete stone with different performance indicators is the quality of the components used and especially the use of additives for different purposes.

When using fine sand in concrete mixtures, the specified strength of concrete without increasing cement consumption can be ensured by a complex binder consisting of a standard amount of cement and fine mineral additives. Finely ground quartz sand, fine silicate brick powder, ash, soot, and a mixture of soot with quartz sand are recommended as additives [1].

Studied the preparation of different types and compositions of binder materials with the same cement consumption and water-cement ratio, different aggregate concretes based on these binders, and their hardening conditions. When using different additives, the dependence on changes in the water-cement ratio and properties of concrete was determined. The authors conducted a study aimed at improving the basic properties of hydraulic concrete mixture through the use of local mineral additives: volcanic rocks and activated man-made waste. Local volcanic rocks such as Tovuz track, Jeyranchol volcanic ash, and man-made waste - aluminum production waste and furnace slag are used in the Ganja aluminum processing plant. Mineral additives in the amount of 5-20% of cement consumption were included in the mixture. A comparative analysis of the results shows that it is possible to use finely ground additives when replacing 5-15% of cement. The use of these local additives has the same effective effect as microsilicate [2].

Compositions of an alkali-mineral binder have been developed based on volcanic rocks located on the territory of Azerbaijan (Tauz highway, ash from the Jeyranchol and Dzhaibrail deposits) and alumina production waste using physico-chemical research methods. The hardening processes of alkali-mineral binders and concrete based on them have been studied [3, 4].

The role of inert mineral additives in concrete technology is considered. It has been established that it is advisable to use inert mineral additives together with superplasticizers to prepare concrete mixtures with high workability and reduced cement consumption. It has been shown that the negative effect of inert additives on strength decreases with a decrease in the water-cement ratio due to an increase in the proportion of cement hydration products and a decrease in the pore volume in cement stone prepared using inert mineral additives. It has been established that the most promising direction for using these materials is the production of highly flexible and self-compacting concrete of low and medium classes with high frost resistance, water resistance and corrosion resistance [5].

The importance of using mineral additives at the present stage of development of concrete technology is considered. It has been shown that the combined use of these additives and highly effective superplasticizers makes it possible to reduce the clinker content in concrete with improved technological and operational properties, which is an important factor in the development of the construction industry. Experimental studies of the influence of microquartz (pulverized quartz) and blast furnace slag on the water-reducing effect of superplasticizers in self-compacting fine-grained concrete showed that when 30% of cement is replaced with mineral additives, there is a significant decrease in the effectiveness of water-reducing additives. It has been established that, despite a significant decrease in the efficiency of superplasticizers in compositions with mineral additives, it remains quite high - in most compositions the water-reducing effect does not fall below 35% [6].

The cement industry has been using waste as a raw material for many years. Waste is also used as alternative fuel. Cement plants are an important element of the waste management system and fit the idea of a circular economy. When waste is recovered in the cement production process, direct and indirect CO_2 emissions are partially avoided. This article discusses the cement industry in Poland. The current situation in terms of the use of alternative fuels and raw materials in Poland, the different types of waste and the amount of waste used is discussed. The article discusses changes in the amount of waste (the increase in the amount of waste used as raw materials from the year 2006 to the year 2019) and the types of waste recovered in the cement production process and the possibility of closing material cycles on the plant scale (recycling to the primary process – cement kiln dust) and industry (using waste from other industries: metallurgy – granulated blast furnace slag, iron bearings; energy production – fly ash, reagypsum/ phosphogypsum, fluidized bed combustion fly ash, and fluidized bed combustion bottom ash; wastewater treatment plants – sewage sludge, etc.). The analysis shows that the role of cement plants in waste management and the circular economy in Poland is important. Industrial waste from metallurgy, power plants, heat and power plants, wastewater treatment plants, and municipal waste is used as the raw material for the cement industry, leading to an industrial symbiosis [7].

To sustain the environment, it is crucial to find solutions to deal with waste, pollution, depletion and degradation resources. In construction, large amounts of concrete from buildings' demolitions made up 30-40 % of total wastes. Expensive dumping cost, landfill taxes and limited disposal sites give chance to develop recycled concrete. Recycled aggregates were used for reconstructing damaged infrastructures and roads after World War II. However, recycled concrete consists fly ash, slag and recycled aggregate, is not widely used because of its poor quality compared with ordinary concrete. This research investigates the possibility of using recycled concrete in construction applications as normal concrete. Methods include varying proportion of replacing natural aggregate by recycled aggregate, and the substitute of cement by associated slag cement with fly ash. The study reveals that slag and fly ash are effective supplementary elements in improving the properties of the concrete with cement. But, without cement, these two elements do not play an important role in improving the properties. Also, slag is more useful than fly ash if its amount does not go higher than 50%. Moreover, recycled aggregate contributes positively to the concrete mixture, in terms of compression strength. Finally, concrete strength increases when the amount of the RA augments, related to either the high quality of RA or the method of mixing, or both [8].

Industrial wastes have been widely used worldwide in the construction industry as a pozzolana aiming to reduce Portland cement utilization and to produce economical, energy-efficient, and environment-friendly concrete. Fly ash is a well-recognized and extensively used pozzolana in concrete, whereas pumice has been scarcely used for this purpose. This study intends to experimentally investigate the beneficial utilization of textile industry waste-derived pumice powder (PP) and its comparison with Fly Ash (FA) in concrete. A total of ten mixes of concrete were prepared with PP, FA, and their ternary mixes (PF) by replacing cement with 15 %, 25 %, and 35 %, respectively. The results show that PP possesses higher pozzolanic potential attributed to the presence of higher content of amorphous silica (SiO_2) as detected in the X-Ray Fluorescence (XRF) and X-Ray Diffraction (XRD) test and justified by the Strength Activity Index (SAI). Moreover, the addition of both pozzolana enhances rheological properties along with the workability of fresh concrete. In the case of Mechanical properties, the inclusion of 25 % PP shows better performance among all mixes, whereas FA mixes gain strength in later ages. Furthermore, the hydration products assessed by thermogravimetric analysis (TGA) and Fourier-transform infrared spectroscopy (FTIR) analysis justified the formation of secondary hydration products and higher pozzolanic potential of PP [9].

This paper reports a part of an ongoing experimental laboratory investigation being carried out to evaluate the mechanical properties of concrete made with mineral admixtures and local Jordanian materials. Various percentages of Silica Fume (SF) and Fly Ash (FA) were added at different water/ cementitious (w/cm) ratios. Concrete specimens were tested and compared with plain concrete specimens at different ages. Results indicated that compressive as well as flexural strengths increased with mineral admixture incorporation. Optimum replacement percentage is not a constant one but depends on the w/cm ratio of the mix. SF contributed to both short and long-term properties of concrete, whereas, FA showed its beneficial effect in a relatively longer time. Adding of both SF and FA did not increase compressive strength in the short-term, but improvements were noticed in the long-term. Compared with compressive strength, flexural strength of SF concretes has exhibited greater improvements. Relationships between the 28-day flexural and compressive strengths have been developed using statistical methods. It is concluded that local concrete materials, in combination with mineral admixtures, can be utilized in making High Strength Concrete in Jordan and such concrete can be effectively used in structural applications [10].

The fiber-reinforced concrete mixture includes, %: Portland cement 26.85-27.8%, quartz sand 53.7-55.6%, high-modulus fibers - wave-shaped steel fiber made of wire and amorphous metal fiber in a ratio of 1: 0.4 - 2.4, respectively , with a total percentage of reinforcement by volume equal to 1.5-2.5%, 5.4-8.7% water - the rest. The technical result is an increase in the tensile strength in bending and crack resistance of fiber-reinforced concrete obtained from a fiber-reinforced concrete mixture [11].

In this study, the results of polypropylene fibers reinforced concrete properties have been presented. The compressive strength, permeability and electric resistivity of concrete samples were studied. The concrete samples were made with different fibers amounts from 0 to 2 kg m^{-3}. Also, the samples fabricated with coral aggregate and siliceous aggregate were examined and compared. The samples with added polypropylene fibers of 1.5 kg m^{-3} showed better results in comparison with the others. Moreover, coral aggregate concrete showed less electric resistivity and less compressive strength in comparison with samples fabricated of siliceous aggregates. It is concluded that the coral aggregates are not suitable for making concrete or using in concrete structures in the onshore atmosphere [12].

2. Purpose of the work

The purpose of the presented work is to obtain a SiO_2-containing mineral-active additive prepared by grinding natural effusive rocks and studying its effect on cement systems, applying it in the development of heavy concrete and fiber concrete composition based on modified cement. Studies have shown that it is possible to activate natural rocks as industrial waste by grinding pomegranate and to apply it as a mineral-active additive in the production of adhesive materials and in the production of concrete for various purposes.

3. Raw materials and materials

In the experiments, Holcim Expert 42.5 R brand cement produced by the Republic of Azerbaijan, sand from the Bahramtepe deposit and crushed stone from the Gudiyalchay quarry located in the Guba region and fine sand were used as fine fillers. S520 brand superplasticizer, HP777 brand hyperplasticizer, and Sika Fiber PPM-12 brand polypropylene fibers were used in order to regulate concrete properties. In the experiments, the quartz sand of the Umbaki field, located in the territory of the Republic of Azerbaijan, was used after grinding to a specific surface of ≥ 5000 cm^2/g. X-ray spectroscopic and X-ray analyzes of the quartz sand of the Umbakı deposit were carried out at the analytical center of the Institute of Geology and Geophysics. The chemical composition of the quartz sand of the Umbaki deposit (in % by mass):SiO_2 – 95, 69; Al_2O_3– 0,8;Fe_2O_3– 2,51; CaO – 0,71; Na_2O – 0,01; MgO – 0,01; P_2O_5 – 0,01; SO_3 – 0,01; K_2O – 0,01; TiO_2 – 0,01; MnO – 0,01; Cl^- – 0.01; YTİ – 0,19(denotes the amount of volatile components at a temperature of 9500C) and its mineralogical composition is α-quartz SiO2 (95%), hematite Fe2O3 (2%) and feldspar (3%).

4. Methodology

Extra-quartz sand of ultra-garnet was dried to a constant mass at a temperature of 105-1100C in a FR-AG 278 type laboratory drying cabinet, 5000 cm2/g of ultra-garnet was ground in a laboratory mill, and then the orangeness was determined in a granulometric device (Mastersizer 3000). Bending and compressive strength indicators of cement mortar UTCM-0120/E and UTCM-0121/E, compressive strength limit of concrete stone were studied in UTEST UTC-4320 hydraulic press. Optimization of concrete compositions in terms of composition and properties was carried out by applying the mathematical-statistical planning method of 2^n-type experiments.

5. Work progress

Experiments were conducted in two stages. In the first stage, the effect of ground natural raw material - Umbaki quartz sand and ultra pomegranate as a mineral-active additive on cement-sand systems was studied, and in the second stage, modified heavy concrete and polypropylene fiber concrete compositions were processed using the modified adhesive material.

The mortar mixture (cement: sand mixture) was prepared in the ratio of 1:3. In order to study the influence of SiO_2 addition of ultramarine on the properties of the solution, standard samples were prepared using the amount of 5-20% of the cement share (total consumption of cement). In order to determine the effect of the additive on the properties of cement-sandstone, samples with normal thickness without additive were prepared in parallel. The cement-water ratio was kept constant in the experiments. The normal consistency and holding time of the prepared solution were determined in the Vika device, and 3 pieces of 40x40x160 mm size bars were prepared from each composition. The specimens were tested after curing by the standard method. The test results are given in Table 1 and Figure 1.

Table 1: Effect of natural mineral-active additive containing SiO_2 on the properties of cement-sand systems.

№	Composition, % by mass		Test results							
	Cem 42,5	Add	Normal hardness, %	Holding period		Medium density (kg/m^3)	Strength index, MPa			
							7 days		28 days	
				Start minutes	End hours		In bending	In compression	In bending	In compression
1	100	0	28	190	4	2,05	4,65	29,7	6,2	39,5
2	95	5	28	191	4,5	2,08	4,67	29,9	6,3	41, 8
3	90	10	28	191	4,5	2,12	4,72	30,29	6,47	42,5
4	85	15	28	191	4,5	2,08	4,50	26,92	5,76	39,0
5	80	20	28	191	4,6	2,05	4,17	26,01	4,9	36,3

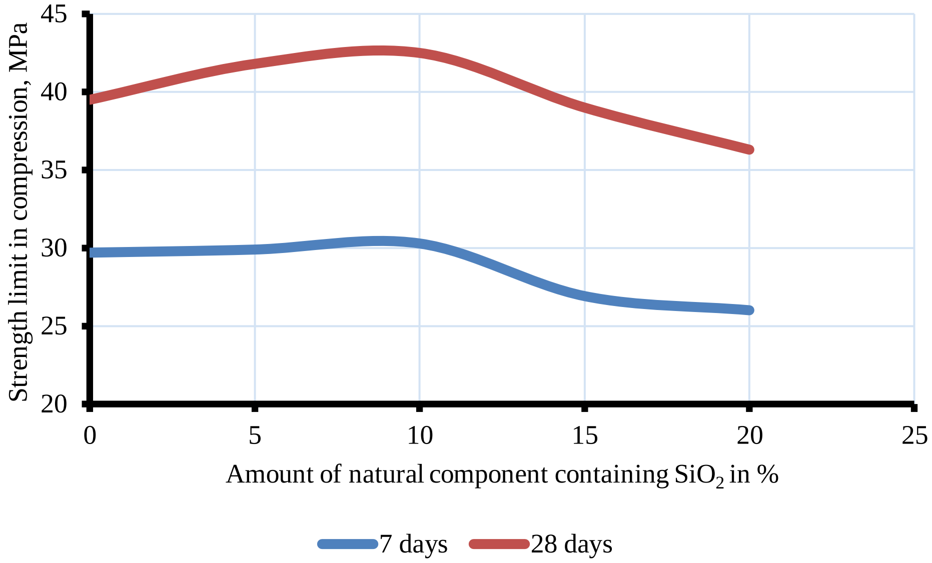

Figure 1: Dependence of cement stone strength on the amount of SiO_2 component of ultramarine.

As can be seen from the table, when the SiO_2 component of the used ultra-garnet is used up to 8% of the cement consumption, the average density, compressive and bending strength limits of cement-sandstone have a positive effect on the main physical and mechanical indicators of 1.46%, 7.59% and 4 increased by 35%. The graphic representation of the limit of compressive strength shows that the use of 10% SiO_2 addition of ultra garnet made on the basis of quartz sand of the Umbaki field will give a more effective result.

In the next stage of research, the influence of the mineral component containing SiO_2 on the properties of ordinary concrete was studied. In the experiments, the heavy concrete composition was developed using locally produced materials of the Republic of Azerbaijan. S520 brand superplasticizer additive was also used in order to ensure a comfortable fit of the concrete mixture into the mold.

In order to study the interaction of the used components, the mathematical-statistical planning method of the experiments was applied and the component optimization was carried out. In order to reduce the number of influencing factors (components), the consumption of fillers and water was kept constant according to the initial composition. Three variables were selected in the experiments. Cement is X1 factor, X2 factor is a mineral component containing ground SiO_2 of pomegranate, and X3 factor is considered as a plasticizing additional effective component.

Within the framework of influencing factors, an experimental plan was established and the experiments were conducted in laboratory conditions. The mixtures were prepared and the ease of settlement index of the ready-made concrete mixture was determined by means of a truncated cone using a standard method. Then three standard samples of 150x150x150 mm size of each composition were prepared, hardened and tested under normal conditions. The test results were statistically analyzed using a computer program, the regression coefficients were found, and the factors affecting the compressive strength of concrete were determined. According to the test results of concrete prepared with superplasticizer and SiO_2-containing mineral additives, the mathematical model (regression equation) of the compressive strength limit is defined as follows:

$$R_{str} = 39{,}73 + 0{,}39X_1 - 1{,}23X_2 + 0{,}53X_3 + 0{,}85X_1X_2 - 1{,}7X_1X_3 + 1{,}07X_2X_3 - 0{,}68X_1X_2X_3$$

Analysis of the model and regression coefficients show that in order to increase the compressive strength of the heavy concrete obtained with such a composition, it is necessary to partially increase the consumption of cement (factor X1), decrease the amount of fine filler (factor X2), and partially increase the amount of coarse filler (factor X3). At the same time, it is manifested in the interaction of these components on the strength of concrete. Thus, by reducing the interaction of X1X3 and X1X2X3 factors, an increase in strength is observed.

Taking into account these conditions, the heavy concrete composition was optimized by applying a short rise path (Table 2).

As can be seen from Table 2, the compressive strength limit of the test samples based on the heavy concrete mix obtained using the natural mineral-active additive containing SiO_2 and S520 superplasticizer varies with little difference around 43 MPa. Taking into account the efficiency from the economic and practical point of view, the optimal composition of the modified heavy concrete mixture with crushed SiO_2-containing mineral and superplasticizer additive of pomegranate is adopted in the ratio of cement: SiO_2-containing mineral additive: sand: crushed stone: S520 = 1: 0.105: 1.27: 3.62: 0.017 it is effective from a technical and economic point of view. The compressive strength of concrete stone with this composition was 43 MPa, and the average density was 2380 kg/m^3.

In the experiments, the production of fiber concrete with the application of natural mineral additive containing ultranarin SiO_2 was studied. Taking into account the field of application of fiber concrete, 500 brand concrete composition was used. In order to improve the properties of concrete, ground quartz sand of ultra pomegranate was used as a mineral-active additive, S520 brand superplasticizer, HP 777 brand hyperplasticizer and SikaFiber PPM-12 brand polypropylene fibers were used as a plasticizer. In order to reduce the number of influencing factors in the experiments, the heavy concrete composition was kept constant. In order to study the effect of the three effective components used and to reduce the number of experiments, experiments were carried out according to the mathematical-statistical planning method. At this time, plasticizing additive and mineral-active additive were considered to reduce the consumption of cement, and fiber fibers were accepted as reducing the consumption of coarse filler, and accordingly, the consumption of basic materials was reduced. Taking into account the experimental conditions, the plasticizer additive was X1 factor, X2 factor - pomegranate ground quartz sand, and X3 factor - fiber fibers.

Table 2: Optimizing the composition of heavy concrete with SiO_2-containing natural mineral admixture and S520 superplasticizer admixture according to the limit parameter of compressive strength by short elevation.

	Factors affecting by mass, %			Compressive strength limit, R_{str}, MPa		Average density in dry state, γ_{qur}, kg/m^3
	X_1	X_2	X_3	the account is actual	the account is actual	
0	359	48,15	5,78	43,31		
b_i	0,53	-1,71	0,79			
ΔX_i	50	24,07	2,41			
$b_i\Delta X_i$	26,5	-41,16	1,9			
Round step	+2,12	-3,28	+0,152			
0	359	48,15	5,78	41,21	41,05	
1	361,12	44,87	5,93	42,98	43,0	
2	363,24	41,59	6,084	43,21	43,1	
3	365,38	38,31	6,23	43,39	43,01	2379
4	367,5	35,03	6,38	43,52	43,0	

The specimens were prepared, cured and tested after 28 days. Two types of plasticizing additives (S520 brand superplasticizer, HP 777 brand hyperplasticizer and according to the results of the experiment, it was statistically analyzed with a computer program and fiber concrete with the average value of the compressive strength limit R_(k.hp.f.s.)^28= 48.78 MPa was obtained.

Based on the statistical analysis, regression coefficients and X1, X2, X3, X1X2, X1X3, X2X3, X1X2X3 factors affecting the compressive strength of concrete were determined. Taking into account the regression coefficients of the influencing factors, a mathematical model of the compressive strength limit of the crushed quartz sand of pomegranate and polypropylene fiber fiber concrete with hyperplasticizer additives was developed.

Considering the signs of the regression coefficients in the received model, it is possible to determine that each of the influencing components used in the preparation of the samples has a different effect on the strength index of concrete, individually and in interaction. Thus, it is possible to increase the strength of concrete within the framework of influencing factors by reducing the amount of hyperplasticizer (less) additive and polypropylene fibers (more) relative to the average limit, but by partially increasing the amount of natural mineral additive containing ultranar SiO_2. By increasing the factors X1X2, X1X3, which are an indicator of the interaction of components, their interaction has a positive effect on the compressive strength of concrete, and by reducing the interaction of X2X3 and X1X2X3, it affects the strength of fiber concrete. Considering what has been said, the optimization of the studied composition using the random replica (short rise) method was carried out according to the following Table (Table 3).

Table 3: Optimizing the composition of fiber concrete obtained on the basis of polypropylene fibers with hyperplasticizer, natural mineral addition containing ultranarin SiO_2, according to the limit parameter of compressive strength, by means of a short increase.

	Factors affecting by mass, %			Compressive strength limit, R_{str}, MPa		Average density in dry state, γ_{qur}, kg/m^3
	X_1	X_2	X_3	the account is actual	the account is actual	
0	11	15	18,8	48,78	45,89	2264
b_i	-0,22	+0,44	-4,97			
ΔX_i	7	5	6,25			
$b_i\Delta X_i$	-1,54	2,22	-31,06			
Round step	-0,15	+0,22	-3,1			
1	10,85	15,22	15,65	51,33	50,98	
2	10,7	15,44	12,55	54,02	53,79	
3	10,55	15,66	9,45	56,85	55,90	
4	10,4	15,88	6,35	59,82	58,92	2475

Taking into account the test results and the levels of variable factors, the compressive strength of the fiber concrete with the optimal composition based on hyperplasticizer, ground quartz sand and polypropylene fibers increased by 8.98 MPa compared to ordinary concrete, being 58.98 MPa. The composition of this proposed concrete (1 m^3) according to cement – 534.12 kg; sand - 530 kg; crushed stone - 1078.65 kg; HP - 777 brand hyperplasticizer - 10.4 kg (1.89% of adhesive consumption); ground quartz sand of ultra pomegranate - 15.88 kg; polypropylene fibers - 6.35 kg. (cement: natural mineral additive containing SiO_2 of ultra pomegranate: sand: crushed stone: HP 777: polypropylene fiber = 1: 0.029: 0.99: 2.02: 0.019: 0.0119).

The plan of the experiments conducted using S520 superplasticizer additive was established and the test was carried out. According to the test results, the average limit of the compressive strength of the samples R_(k.sp.f.s.)^28= 47.05 MPa, regression coefficients $b1$= - 1.55; $b2$ = -0.87; $b12$ = + 1.61; $b3$ = - 0.30; $b13$ = + 2.18; $b23$ = - 0.19; $b123$ = – 0.77 and X_1, X_2, X_1X_2, X_1X_3, $X_1X_2X_3$ indicators of factors affecting the compressive strength limit of concrete were determined.

The mathematical model of the compressive strength limit of S520 brand superplasticizer, natural mineral additive containing ultranarin SiO_2 and polypropylene fiber-based fiber concrete was obtained as follows:

$$R\_(k.sp.f.s.)\hat{}28 = 47{,}05 - 1{,}55X_1 - 0{,}87X_2 + 1{,}61X_1X_2 + 2{,}18X_1X_3 - 0{,}77X_1X_2X_3$$

Looking at the regression coefficients, it is necessary to reduce the amount of superplasticizer additive (X1 factor) and NKQ additive (X2 factor) in order to increase the compressive strength limit of the new composite fiber concrete. Despite the increase of superplasticizer and SiO2-containing natural mineral additives (X1X2), superplasticizing polypropylene fibers (X1X3) in the interaction of the new composite fiber concrete, the three factors increase the compressive strength limit of the new composite fiber concrete by reducing (X1X2X3) in the interaction.

Taking into account the influence of changing factors, the composition of the new composition of fiber concrete was optimized by means of a short rise. The compressive strength of the test samples based on the concrete mixture obtained using Ultranar's SiO_2-containing natural mineral admixture, S520 brand superplasticizing admixture and polypropylene fibers was 50.90 MPa. Taking into account efficiency from the economic point of view, a new composition based on crushed quartz sand of pomegranate, superplasticizing additive and polypropylene fibers for the preparation of concrete for 1m3 of cement: natural mineral additive containing SiO_2 of ultra pomegranate: sand: crushed stone: S 520: polypropylene fiber = 1: 0.022: 0.98 : 1.97 : 0.0064 : 0.034 ratio selection of composition was considered suitable for the purpose. The compressive strength of concrete stone with this composition was 51 MPa, and the average density was 2403 kg/m^3.

6. Results

The possibility of obtaining a natural mineral-active supplement containing SiO_2 of ultra pomegranate on the basis of Umbaki quartz sand, located in the territory of the Republic of Azerbaijan, was determined experimentally. It was determined that when this type of additive is used up to 8-10% of the cement consumption, the compressive strength limit of cement-sand systems increases by 7.9%, the flexural strength limit by 4.35%, and the average density increases by 1.46%. With the complex use of Ultranar's SiO_2-containing mineral additive, superplasticizing, hyperplasticizing additives, these indicators increase even more. Using the method of mathematical statistical analysis of experiments, the composition of heavy concrete and fiber concrete modified in terms of composition and properties was optimized by taking into account the influencing factors of the compressive strength limit parameter.Cement with a compressive strength limit of 43 MPa, an average density of 2379 kg/m^3: SiO_2-containing mineral additive: sand: crushed stone: S520 = 1: 0.105: 1.27: 3.62: 0.017 ratio of heavy concrete composition, compressive strength limit is 49.70 MPa, cement with an average density of 2403 kg/m^3: natural mineral additive containing SiO_2 of ultramarine: sand: crushed stone: S 520: polypropylene fiber = 1: 0.022: 0.98: 1.97: 0.0064: 0.034 fiber concrete composition with superplasticizer, in compression cement with a strength limit of 59 MPa, an average density of 2475 kg/m^3: natural mineral additive containing SiO_2 of ultra pomegranate: sand: crushed stone: HP 777: polypropylene fiber = 1: 0.029: 0.99: 2.02: 0.019: 0.0119 hyperplasticizing fiber concrete the composition has been worked out.

Authors' contributions

The author read and approved the final manuscript.

Conflicts of interest

The author declares no conflict of interest.

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Data availability

No new data were created.

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