

COMPRESSIVE STRENGTH OF CONCRETE USING NANO-SILICA

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Abstract : The purpose of this project is to study the effect of Ferro cement geopolymer concrete by replacing cement. The most important add-on's in the conventional concrete is the Portland cement. The production of cement in the factory emits enormous amount of carbon- dioxide which pollutes the environment. Therefore geopolymer concrete is provided. Because, this concrete uses no Portland cement, instead geopolymer cement is used which is obtained from the reaction of low calcium fly ash with the alkaline solution. The geopolymer cement is eco-friendly. It increases the strength, durability and resistance to attack in peaty/acidic environments. It is proposed to determine and compare the differences in properties of Ferro cement geopolymer concrete with Nano silica. The investigation are to be done by using several tests which include workability test, sieve analysis, specific gravity test, compression test, and flexural strength.

Keywords : Geopolymer concrete, Portland cement, Nano silica, alkaline solution.

I. INTRODUCTION

Pollution is the major problem the world is facing today. Ordinary Portland cement (OPC) will produce large amount of carbondioxide which results in environmental pollution. As an alternative binder to the portland cement the geopolymer technology shows considerable promise for application in concrete industry. The geopolymer concrete significantly reduce the CO2 emission to the atmosphere caused by the cement industries. Geopolymer concrete utilize waste materials from industries such as fly ash, silica fume and GGBS. The geopolymer concrete has two limitations such as the delay in setting time and the necessity of heat curing to gain strength.

II. MATERIAL

Flyash

Fly ash is a fine powder that is the byproduct of burning pulverized coal in electric power plants. Low calcium class F type fly ash is used

Fine Aggregate

Natural sand is used as fine aggregate.

Coarse Aggregate

Coarse aggregate of sizes 20 mm and 10 mm are used.

Water

Water is used for both mixing and curing of specimen as per the guidelines of IS:456:2000 and IS:3025-1964 part 22.

Nano Silica

Colloidal form of Nano silica has been used i.e. nanosilica in dispersion with water in 40:60 ratio (40% Nanosilica). Nano content with particle size in the range of 5-40 nm.

Alkaline liquids

Sodium silicate solution and sodium hydroxide solution of 10M concentration (400gm in 1L of solution) are to be prepared,(1M=40gm).

III. EXPERIMENTAL ANALYSIS

The experimental investigation is carried out with Geopolymer concrete specimen such as cube, cylinder and beam of sizes 150x150x150 mm,150x300 mm and700x100x100 mm respectively.

a. Compressive strength test

Compressive test of the concrete provides an idea about all the characteristics of concrete. The compressive test is carried out on specimens of cube of sizes 150mm. The cubes are tested as per IS: 516-1979.

b. Flexural strength test

Flexural strength test evaluates the tensile strength of concrete indirectly. Beams of size 150mm x 150mm x 700mm were cast. After 24 hours the specimen were remolded and subjected to water curing.

c. Split tensile strength test

Split- tensile strength is indirect way of finding the tensile strength of concrete by subjecting the cylinder to a compressive force. Cylinders of size 150mm diameter and 300mm long were cast. After 24 hours the specimen were remoulded and subjected to water curing. After 3, 7, 14 and 28 days of curing the cylinders were taken allowed to dry and tested in compression testing machine by placing the specimen horizontal. The ultimate load of the specimen is horizontal. The ultimate load of the specimen is at which the cylinder failed

IV . RESULT AND DISCUSSION

Table-1: compressive test results of geopolymer concrete with nanosilica

Percentage of nanosilica	7 days	14 days	28 days
0 %	18.45	23.35	26
0.5 %	18.13	24.15	29.2
1 %	21	25.89	31.3
1.5 %	22.85	27.32	33.4
2 %	21.19	26.09	32.6

Table-2: Split tensile test results of geopolymer concrete with nanosilica

Percentage of nanosilica	7 days	14 days	28 days
0 %	1.62	1.89	2.4
0.5 %	2.21	2.46	2.95
1 %	2.82	3.11	3.42
1.5 %	3.31	3.35	3.87
2 %	2.25	2.34	2.64

Table-3: Flexural Strength test results of geopolymer concrete with nanosilica

Percentage of nanosilica	7 days	14 days	28 days
0 %	2.12	2.21	2.59
0.5 %	2.44	3.21	3.84
1 %	2.88	3.36	3.99
1.5 %	3.46	3.88	4.36
2 %	3.43	3.61	3.86

DURABILITY TEST

Table-4: Carbonation test

S.No	days	Weight of specimen(kg)	color	quality
1	28	8.14	Pink	Good
2	56	8	Pink	Good
3	84	7.9	pink	good

From the above tables it can be known that the average compressive strength of geopolymer concrete with Nano silica cube is 1.3 times more than normal Geopolymer concrete. Average split tensile strength of geopolymer concrete with nanosilica cylinder is 1.3 times more than normal geopolymer concrete. Average flexural strength of geopolymer concrete with nanosilica beam is 1.2 times more than normal geopolymer concrete. Since there is no changes in color, Geopolymer concrete is more durable.

V CONCLUSION

Using the test results , it can be concluded that with the increases in the percentage of nanosilica the various strength characteristics of concrete increased up to 1.5%of nanosilica. The above discussions described that the influence of NS along with cement, cement mortars, concretes, supplementary cementitious materials and other cementitious materials. The decrease in the strength characteristics of concrete with increases in the nanosilica content beyond 2% is due to poor quality of binder formed in the presence of high content nanosilica and

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