

Comparitive Study on Conventional and Geopolymer Concrete with and without Poly Propylene Fiber

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Abstract— Geopolymer is emerging as an alternate green material in the construction industry in order to produce ecofriendly concrete. it is necessary to replace cement by industrial by products such as flyash , GGBS with alkaline liquid such as sodium hydroxide of 8M and 10M and sodium silicate solution by varying percentage of polypropylene fiber 0.9 and 1.35kg per m³ to the volume of the binder content for M₄₀ mix designation. The main focus to study will be investigating the increasing the compressive strength of the concrete after adding polypropylene fiber.

Keywords— *Geopolymer GPC; Conventional concrete CC; flyash; GGBS (ground granulated blast furnace slag); alkaline solutions sodium hydroxide, sodium silicate (NaOH,Na₂SiO₃); Polypropylene fiber-PPF.*

I. INTRODUCTION

In order to control the given house effect due to the release of CO₂ to the environment during calcination process. Here the contemporary material is using called geo-polymer concrete thus not mandatory here are we are completely replacing the cement from sly-ash and GGBS and water by alkaline solutions such as NaoH and Na₂SiO₃ for the using of GPC is done by sun light .

The Polypropylene fiber used by various densities. It is good in tenacity and resiliency properties. The main advantages of Recron 3s virgin Polypropylene fiber are rebound loss reduced by 50% o 70% results in saving expensive mortar, binding material and sand. Time taken for plastering is reduced & work is completed faster, reduces cracks during plastering and hardening stages.

Reduces water seepages and protects steel in concrete from corroding & water from dampening, protects corners in pre-cast slabs & concrete flooring, increases abrasion resistance by 40% there by increasing life of roads walkways, floor, also reduce pitting of the floor.

Here the experimental investigation of compressive strength, tensile strength & thermal resistance of the GPC with & without polypropylene fiber.

II. METHADODOGY

A. MATERIALS USED

- Cement = OPC (53) (BIRLA SHAKTHI CEMENT).
- Fine aggregate =Thalakadu River sand
- Coarse aggregate = 20mm aggregates
- Fly ash = (Thermal power plant Raichur)
- GGBS = (JSW Thoranagallu Bellary)
- Alkaline liquids = NaOH, Na₂SiO₃
- Polypropylene fiber = recorn 3s (expected ratio 1:300)
- Chemical admixture = super plasticizers (complast sp430)

B. MIX DESIGN

Mix design for M₄₀ grade concrete by referring IS 10262-2009

➤ Total quantities of materials for 1 m³ conventional concrete

- Cement content = 350kg/m³
- Water content = 157.6 kg/m³
- Fine aggregate =708.9 kg/m³
- Coarse aggregate = 1225.40 kg/m³
- Chemical admixture =3.5kg/m³
- w/c =0.4

Mix design for G₄₀ grade concrete by referring IS 10262-2009

➤ The total quantities of materials for 1 m³ of Geo-polymer concrete

- Mass of binder = 345 kg/m³
- Mass of fluid = 59.14 kg/m³
- Mass of Na₂SiO₃=147.85 kg/m³
- Fine aggregate = 831.6 kg/m³
- Coarse aggregate = 1016.4 kg/m³

C. TESTS

- Compressive strength test
- Split tensile strength test
- Temperature effect

III. RESULTS

TABLE 1 .CC after 28 days of water curing:-

Type of cubes	Compressive strength in Mpa	Tensile strength in Mpa
Without fiber	40.55	2.88
With fiber of 0.9 kg/m ³	45.02	3.2
With fiber of 1.35 kg/m ³	48	3.65

Table 2. CC after temperature effect :-

Type of cubes	Initial Compressive strength in Mpa	Final Compressive strength in Mpa	Loss of strength in %
Without fiber	40.55	35	13.68
With fiber of 0.9 kg/m ³	45.02	39.06	13.23
With fiber of 1.35 kg/m ³	48	41.52	13.50

Table 3. GPC 8M of 14 days sunlight curing :-

Type of cubes	Compressive strength in Mpa	Tensile strength in Mpa
Without fiber	44	3.02
With fiber of 0.9 kg/m ³	47.05	3.48
With fiber of 1.35 kg/m ³	50.02	3.95

Table 4. GPC 8M after temperature effect :-

Type of cubes	Initial Compressive strength in Mpa	Final Compressive strength in Mpa	Loss of strength in %
Without fiber	44	39.55	10.12
With fiber of 0.9 kg/m ³	47.05	42.50	09.68
With fiber of 1.35 kg/m ³	50.02	45.30	09.44

Table 5. GPC 10M of 14 days sunlight curing :-

Type of cubes	Compressive strength in Mpa	Tensile strength in Mpa
Without fiber	45.55	3.88
With fiber of 0.9 kg/m ³	49.02	4.2
With fiber of 1.35 kg/m ³	52.13	4.65

Table 6. GPC 10M after temperature effect :-

Type of cubes	Initial Compressive strength in Mpa	Final Compressive strength in Mpa	Loss of strength in %
Without fiber	45.55	41.38	09.34
With fiber of 0.9 kg/m ³	49.02	44.59	09.12
With fiber of 1.35 kg/m ³	52.13	48.30	08.98

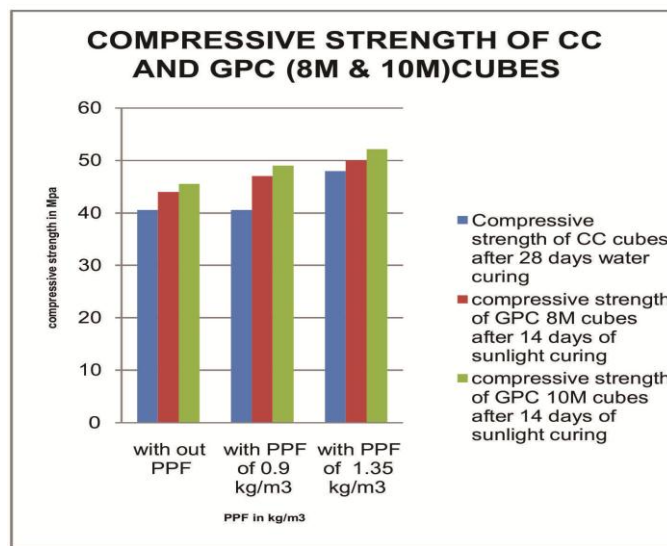


Fig.1 Compressive strength of CC and GPC (8M & 10M) cubes

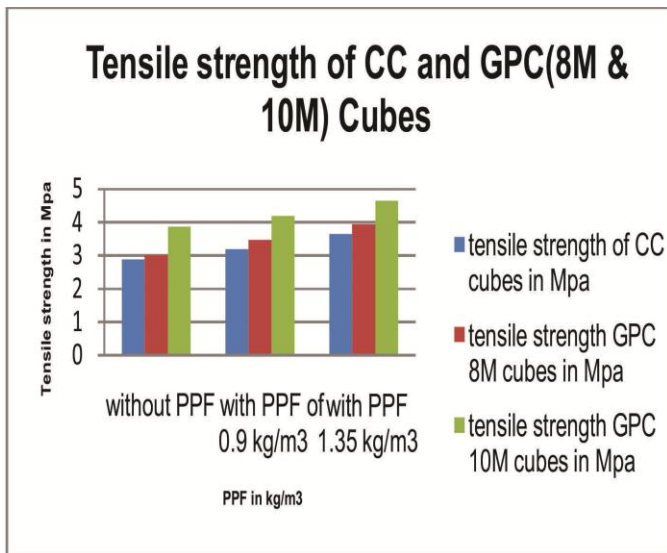


Fig.2 Tensile strength of CC and GPC (8M & 10M) cubes

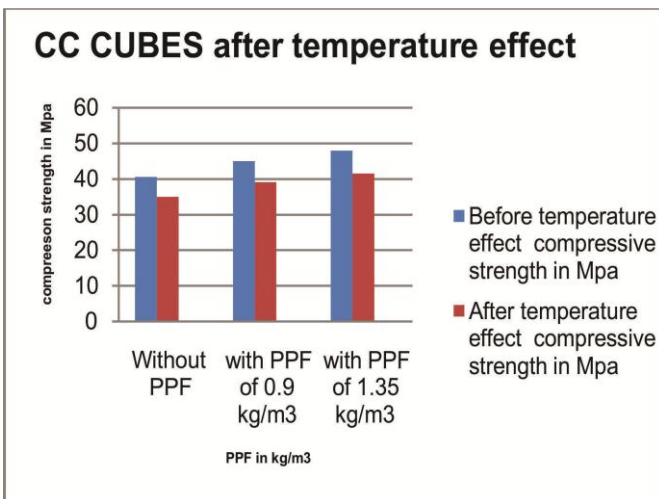


Fig.3 Loss of compressive strength CC Cubes after Temperature effect

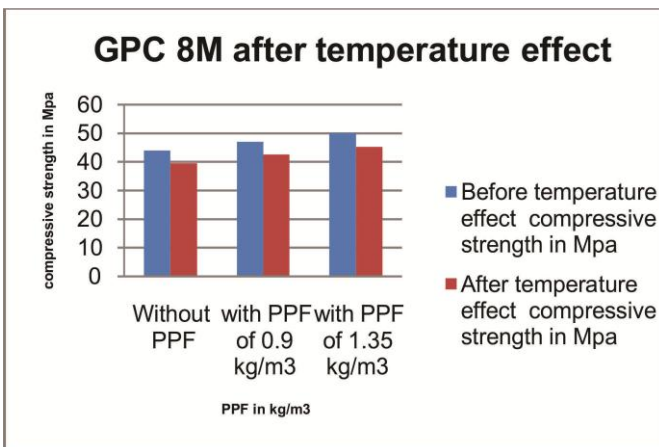


Fig.4 Loss of compressive strength GPC 8M Cubes after Temperature effect

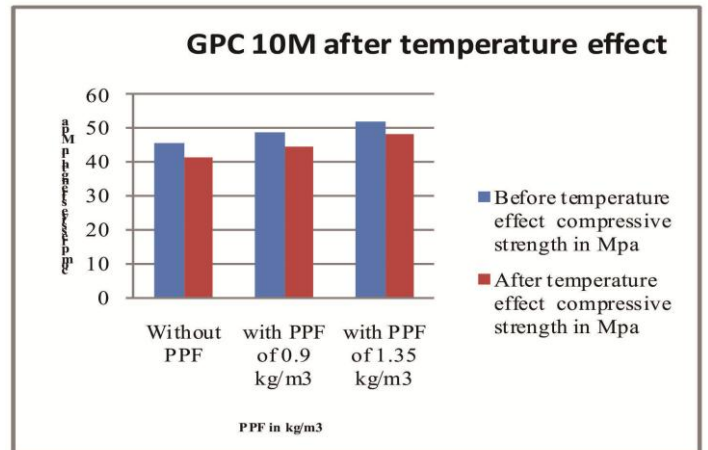


Fig.5 Loss of compressive strength GPC 10M Cubes after Temperature effect

IV. CONCLUSION

Conventional concrete cubes casted and cured. Then it attains its strength after 28 days of water curing. But the geo-polymer concrete attains its strength within 14 days under sunlight curing.

Compressive strength :-

By the comparative study of conventional concrete with and without PPF by the considering the test results. The compressive strength slightly increased in which PPF is added. And also by considering the test results of GPC of 8M & 10M the compressive strength of 10M cubes gains high strength.

Tensile strength :-

By considering the test results have been studied and compared, CC cubes having the fiber shown high tensile strength. As in the GPC also 10M cubes having fiber shown high tensile strength than CC cubes.

Temperature effect :-

Temperature effect is conducted on concrete cubes in laboratory by maintain temperature 100 °c constant.

Test results shows that there is consistence increase in 8-14 % loss of strength, by studying this effect. As temperature increases the lead formation of ettringite reduce the strength absorbed more strength reduction in case of CC without PPF than GPC cubes.

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