ANALYZING THE INFLUENCE OF BLENDED FIBERS ON THE PROPERTIES OF GEOPOLYMER CONCRETE: A COMPATIBILITY STUDY

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ABSTRACT

The most versatile, reliable, and long-lasting building material in the world is concrete. After water, concrete is the material that is used the most frequently, and it uses huge amounts of Portland cement. Since the greenhouse effect generated by CO2 emissions produces an increase in global temperature, which may lead to climate change, it is a problem for sectors, including the cement business. Reducing the amount of cement used in concrete by substituting Geopolymer for cement is one effort to produce more environmentally friendly concrete. The most prospective green and environmentally sustainable cement substitute is geopolymer concrete (GPC). Fly ash and alkaline solutions like sodium hydroxide (NaOH) and sodium silicate (Na2SiO3) are used to create the binder necessary to create geopolymer concrete, which is made without the use of cement. Concrete is fragile, lacks flexural strength, and is only moderately strong in compression. It is weak in tension.

By adding randomly positioned discrete fibers to the concrete matrix, it is possible to change the concrete's performance and make it more ductile. This enhances the concrete's properties when it has hardened, such as flexural toughness, flexural strength, ductility, impact strength, and tensile strength, as well as its ability to avoid or regulate crack initiation, propagation, and coalescence.

In concrete, microfracture develops as a result of the use of steel fibre, load, andenvironmental changes. Recron-3s is a discrete, discontinuous, short polypropylene monofilament fibre that may be utilised in concrete to regulate and arrest cracking. Concrete's bleeding, plastic settlement, heat and shrinkage strains, and stress concentrations caused by external restrictions are all greatly reduced when steel and polypropylene are added.

In the present study the strength of M30 grade Geopolymer concrete is investigated through by addition of various proportions of steel and polypropylene (Recron- 3s fiber) and also intended to show the optimum dosage of steel and Recron 3S. The results had shown overall considerable improvement in the mechanical properties of concrete like compressive strength (CS), tensile strength (TS), Flexural strength (FS) and Durability test. In addition to the effect of both steel and polypropylene fibers influence individually and in combine on

properties of concrete is studied
Results reveals that the blended fibers of RF2SF2 (0.4% of Recron and 1% of steel) with Geopolymer concrete the CS, FS and TS has found to be 22.23%, 21.14% and is 24.57% respectively increase in strength, when compared to that of controlled concrete.
The mass due to Sulphuric acid attack on GPC after the addition of the RF3SF4 the weight is increased with 0.933%. The CS due to Sulphuric acid attack on GPC after the addition of the RF3SF3 is increased with 9.24%.The mass due to Sodium chloride attack on GPC after the addition of the RF3SF3 the weight is increased with 0.91%.The CS due to Sodium chloride attack on GPC after the addition of the RF3SF3 is increased with 4.8%

Key words Geopolymer concrete; Fly ash; Ground granulated blast furnace slag; Steel Fiber, Polypropylene fiber, Durability

I. INTRODUCTION

1.1 General

Concrete is widely used to construct buildings, infrastructure, reservoirs, airports, parking garages, pools, boats, and dams. Concrete is utilized in huge amounts wherever humankind has a requirement for infrastructure. Tonne for tonne, the amount of cement used worldwide is two times greater than the combined amounts of wood, steel, aluminum, and plastic. The use of concrete in the developed world is only surpassed by that of existing water.

Concrete is a material which is the most utilized structure material on the planet. In any case, the creation of concrete means the creation of contamination in view of the discharge of CO_2 during its creation. Emission of CO_2 into the atmosphere is a influence for the industries, even for the cement industries. When the impact of greenhouse gases brought on by emissions is taken into account, a rise in global temperature that could lead to changes in the climate takes place. Cement is a major contribution to the production of CO_2 emissions and this account for 5-8 % of total CO_2 produced as a result of human activities. Cement production already exceeds 2.6 billion tonnes annually and is expanding at a rate of 5%.

Worldwide concrete employment is expanding quickly, thus the creation of acceptable concrete is predicted for both environmental and strength-related reasons. By replacing concrete with GPC, one attempt is being made to make concrete even more eco- friendly by reducing the use of cement. Fly ash and alkaline solutions like NaOH and Na_2SiO_3 are used to create the binder necessary to construct the concrete in geopolymer instead of cement. For the construction of approximately 2.5 cubic meters of top-notch GPC, one tonne of fly ash is required.

An assortment of materials like steel, polypropylene, polyester, nylon, carbon, glass, and basalt fibers can be utilized in fiber reinforced concrete (FRC). Numerous variables, including the kind, flexible characteristics, size, volume fractions, and aspect ratio of the fibers, affectthe attributes of FRC.

The qualities of concrete in the hardened stage, such as flexural toughness, flexural strength, ductility, impact strength, and tensile strength, are significantly improved by the addition of steel fibers. These fibers have already been used in numerous significant projects, including the construction of pavements, industrial floors, and highway overlays in India.

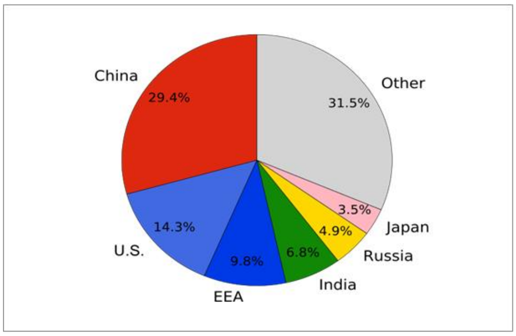


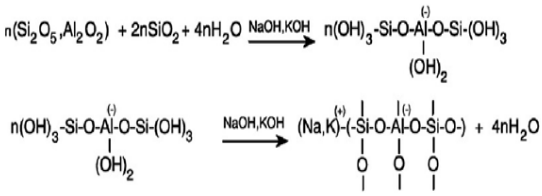
Figure 1.1 Global CO2 emissions by country wise, 2020

Concrete is utilized all around the world in extremely high add up to fabricate structures, bridges, roads, runways and any infrastructure. Concrete has a strong connection to the global economy because it is essential for the advancement of development. Concrete production is expected to increase from 2.55 billion tonnes in 2006 to 3.7–4.4 billion tonnes by 2050, growing by 25% a year. The world's cement production structure by the nations displayed previously.

1.2 Geopolymer concrete

Portland concrete is a key component of ordinary cement. One tonne of carbon dioxide is released into the atmosphere during the production of one tonne of concrete. Up to 85% of the energy and 90% of the carbon dioxide attributed to a normal prepared mixed cement are attributable to Portland concrete. The primary industrial waste used in geopolymer concrete is fly ash. Fly ash is produced from industrial waste and is readily available all over the world. The majority of the fly ash isn't successfully utilized and a huge piece of it is arranged in landfills. Thinking about this, plainly the utilization of geopolymer cement can be demonstrated efficient and furthermore eco-accommodating.

This breakthrough technology is currently being widely used in Australia, Europe, and USA. Itis used for waste containment, street pavements, electric power shafts, rail line sleepers, and concrete mortar. The most recent research is being done to develop geopolymer systems that provide a low-type energy, low CO2 binder with qualities similar to Portland concrete. Similar to this, flow research is focusing on the development of simple to comprehend geopolymer concrete. Utilising geopolymer concrete helps the economy grow, reduces pollution, and is safer for the environment. GPC is currently been used in India's Delhi Metro Project. As a result, it can be said that India has a large market for GPC as a cement substitute.



A substance called GPC doesn't require cement to act as a binder. When all else is equal, alkaline liquids are used to activate the reservoir of materials, such as fly ash, that are rich in Silicon (Si) and Aluminum (Al), to generate the binder. Therefore, concrete is devoidof cement.

Alumino-silicate substances like fly ash, metakaolin, activated bentonites, etc. are examples of geopolymers. In order to create a binder, Davidovits proposed using an alkaline liquid to react with source materials such as byproduct materials like fly ash. The most commonly used raw material for creating geopolymers is fly ash. Great high-strength geopolymers are often class-F fly ash. To form geopolymer precursors and ultimately alumino-silicate materials, Si and Al molecules must dissolve under the influence of an alkaline actuation arrangement. Aluminosilicate-responsive material and solid basic arrangements, such as NaOH and Na2SiO3, are combined to create a geopolymer. The mixture can be adjusted to room temperature or it should be exposed to heat curing.

1.2.1. Ingredients required for creation of Geopolymer binders

The fixings needed for making of geopolymer binders are clarified underneath, Cementitious binders - Various industrial results and normally accessible materials such as aggregates, alkaline binders, alkaline solution and super plasticizers can be utilized to deliver geopolymer concrete.

1.2.2 Benefits to the environment

- Cement industry decreases in greenhouse gas emissions.
- Lessening the amount of coal combustion byproducts disposed of.
- Extending the lifespan of structures made of concrete by enhancing concrete durability.
- Take significant steps to protect the environment from global warming.

GPC is a method which utilizes industrial waste like fly ash (FA) and ground granulated blast furnace slag (GGBS). A tremendous measure of fly ash (FA) is created in nuclear energy stations, causing a few removal related issues as the complete use of FA is just around half of delivered. Removal of fly ash is a developing issue as just 15% of fly ash is presently utilized for high worth addition applications like cement and building blocks, the excess being utilized for landfills. Geopolymer innovation can be suitable cycle innovation use all classes andgrades of FA and along these lines there is an incredible potential for lessening reserves of waste FA materials. GGBS is a by-product from the blast furnaces used to make iron. Geopolymer is utilized as the binder, rather than cementitious material, to deliver concrete.

1.2.4 Advantages and disadvantages of using GPC

Any material is not an idle material with all advantages, geopolymer cement also have advantages as well as disadvantages.

Advantages:

- Has CO2 emissions that are up to 90% lower than OPC concrete.
- Improved thermal insulating qualities.
- Greater heat and fire resistance.
- Offers a practical purpose for 'waste'

materials that are frequently dumped in landfills.

- Increased compressive resistance.
- Save energy by using the waste and by-products.
- Increase in the environmental gain by reducing the huge landfill blindered by the by-products.
- Could also increase the job opportunity by this new technology.

Disadvantages:

- Lack of specifications and guidelines.
- Initial cost is high due to the chemical incorporated with the alkaline activator.
- Climatic conditions affect the strength parameters.

Concrete is weak in tension and strong in compression, hence it need to be supplemented with a material which gives tensile strength to concrete. Fibers are such materials added to concrete to improve tensile strength of concrete.

1.9 Need for the present investigation

Concrete is the most widely used material in the construction. Since GPC behaviour is in similar way as that of OPC, it also shows less tensile strength compared to compressive strength. Fibers improve the tensile strength of concrete. Further Tensile strength of concrete play important role in the construction of pavements etc. It is already identified that fiber addition to concrete improves tensile strength. Hence, the role of fibers on improving Tensile strength of GPC need to be evaluated. Further, the compatibility of new generated fibers such as Recron-3s need to be checked with the Traditional Steel fibers.

1.13 Research significance

- To find the optimum dosage of Recron fibers with GPC.
- To determine the optimum steel fibre dosage when combined with GPC.
- To propose the optimum mixed fiber dosage of Recron and steel fibers with GPC.
- To identify the compressive strength (CS), flexural strength (FS) and split tensile strength (TS) of GPC with optimum fiber dosage of Recron, steel and optimum mixed fiber dosage and without Fibers.

1.14 Scope of the investigation

1. Addition of Recron fibers to GPC in different proportions from 0% to 1% with increase in variation of 0.2% Recron (0%(G1), 0.2%(R1), 0.4%(R2), 0.6%(R3), 0.8%(R4), and 1.0%(R5)). For each mix 6 cubes of size 150x150x150 mm were casted. Altogether total 36 specimens were casted.
2. Addition of steel fibers to GPC in different proportions from 0.2% to 2.0% with increase in variation of 0.2% steel (0.2%(S1), 0.4%(S2), 0.6%(S3),0.8%(S4), 1.0%(S5), 1.2%(S6), 1.4%(S7), 1.6%(S8), 1.8(S9) 2.0%(S10) and 2.5% to 3.5% with increase in variation of 0.5% steel (2.5%(S11), 3.0%(S12), and 3.5%(S13)). For each mix 6 cubes of size 150x150x150 mm were casted. Altogether total 78 specimens were casted

3. Mixed Fibers addition to GPC in different Proportions (i.,e Recron and steel)RF1SF1(0.2,0.5), RF1SF2(0.2,1), RF1SF3(0.2,1.5), RF1SF4(0.2,2), RF2SF1(0.4,0.5), RF2SF2(0.4,1), RF2SF3(0.4,.1.5), RF3SF1(0.6,0.5), RF3SF2(0.6,1), RF3SF3(0.6,1.5). For each mix 6 cubes of 150x150x150 mm were casted. Altogether total 60 specimens were casted.
4. Compressive, flexural, split tensile strength is calculated for optimum dosage of R3, S11, RF1SF3(0.2R,1.5S), RF2SF2(0.4R,1S), RF3SF2(0.6R,1S). The GPC cube, Prisms and Cylinders were casted with optimum dosage of recron of R3, steel S11, Mixed fiber of RF1 SF3, RF2 SF2, RF3 SF1. Altogether total 51 specimens were casted.

II. LITERATURE REVIEW

LITERATURE ON GEOPOLYMER CONCRETE

Annapurna shivakumar et al. (2017) evaluated the mechanical characteristics of GGBS- and FA-based GPC. Geopolymer (GP) has limitations that can be removed by using GGBS, such as sluggish setting at ambient temperature. This evaluation makes an effort to focus on the mechanical characteristics of GPC that include GGBS as an additional repair. To focus on the mechanical qualities, five mix scenarios with shifting GGBS measurements have been taken into account. The results of the tests show that every mechanical property of the FA and GGBS-based GPC is in good agreement with the qualities of conventional concrete (CC).

S.S.Bachhav et al,(2016) explored compound Resistance properties of CC and GPC, thought about the compressive strength of GPC & CC after openness to the carbonation interaction. The compressive strength of CC was seen to be less as contrasted and fly ash based GPC. It increments with increment molarities in an alkaline solution. GPC includes brilliant properties inside both corrosive and salt conditions contrasting with CC, the creation of GPC have an overall higher strength, incredible volume steadiness, well durability.

Pithadiya.S et al (2015) completed an exploratory concentrate on GPC by utilizing GGBS. They led tests on GPC by supplanting FA by GGBS and the examples were relieved at ambient curing just as oven curing. They affirmed that supplanting of FA by GGBS expanded the strength continuously ambient curing arrangement.

Madheswaran C.K et.al (2013) concentrated on the variety of solidarity for various grades of GPC by shifting the NaOH. Various molarities of NaOH were taken to plan distinctive blends and restored in the surrounding temperature. GPC blend definitions in with CS going from 15 to 52 MPa had been created. The examples were tried for their CS at 7 years old and 28 days. The CS of GPC expanded with expanding centralization of NaOH.

LITERATURE ON FIBER REINFORCED CONCRETE.

Pawan Kumar 1, et.al (2016) examined and presumed that the Compressive Strength increments with adding the level of polypropylene fiber. Compressive strength gets most extreme at a specific rates of strands (here 1.50%) and afterward diminishes with adding the filaments. Flexural strength increments with expanding the level of polypropylene fiber. The most extreme flexural strength has gotten at 2.00% of polypropylene fiber. The droop esteem diminishes with expanding the level of polypropylene fiber.

Dr Sunil V Desale, et.al (2015), examined and inferred that, on immersion of Recron 3s fiber with cement matrix, the CS and TS decline with expansion in Recron 3s fiber content, but the FS increments with expansion in Recron 3s fiber content. At the point when muck and Recron3s fiber are added, the ideal measurement of fly ash is 20% and ideal Recron 3s fiber content is 0.4%. Utilization of Recron 3s fiber will lessen the expense of support by decreasing the miniature breaks and porousness and subsequently the solidness will increment. The use of Recron 3s fiber lessens the isolation.

Nandish S C1, et.al (2015), in their exploratory examination inferred that with expansion in with the increment in the addition of filaments to the concrete, the TS and the FS increments somewhat and bit by bit diminishes with additional increment in the level of the strands. CS decline with increasing the duration of curing. Utilising strands will typically improve the FS of the fiber-mixed concrete, which will have a higher value than the control mix. The FS was found to be fourteen percent greater for concrete that contained 2.0%CF and 0.4%PF of fiber than control mix concrete. The TS of the fiber-mixed concrete is more valuable compared to that of the control mix when strands are used. The total solids (TS) were found to be 11.76% greater compared to that of the control mix for fiber contents of 2.0%CF and 0.4%PF. The enlargement of coconut fiber and polypropylene fiber in the concrete mix has been observed to reduce the functioning of the fiber concrete (PF and CF).

Kamaldeep Kaur, (2015), has considered and inferred that addition of recron works on the presentation of concrete at 0.2% and 0.5% addition, beyond 0.5% there is no beneficial outcome on the CS of concrete. Failure example of the shape overall has portrayed that concrete with recron works on break resistance. Addition of strands lessens the usefulness of concrete. Utilization of flyash and superplasticizers works on the functionality.

T.Sandeep, (2015) , considered and presumed that the 28 days in regard of the two grades of concrete is achieving most extreme worth at 25-30% of fly ash replacement. There is an expansion of 12%in CS with addition of FA when analyzed plane concrete. There gives off an impression of being most prominent expansion in 7 days strength with use of fly ash when thought about 28 days strength. Almost 25% more strength is accounted for to have been gotten at 7 days with 25% replacement of fly ash this enjoys a benefit as far as early deshuttering and when the foundation of development is relied upon to be exceptionally high there is a comparative propensity consumed and truth be told all the more pronouncedly at 3days strength of concrete there is a half expansion in strength at 3 days thought about plane traditional concrete. The addition of Recron fiber has additionally expanded beginning 3days and 7days strength. These filaments are causing 30% f expansion in the 28-days CS within the sight of fly ash the most extreme in 28-days strength is seen with 0.25% Recron and 25% fly ash replacement.

III. EXPERIMENTAL WORK

3. Materials

Fly ash

Class F fly ash was used as the base material conforming to ASTM class F. The appearance of FA is shown in Figure 3.1. The Physical characterizes and chemical properties of FA are assumed in

Table 3.1

Aluminium oxide (Al_2O_3)	

Table 3.1 Physical and chemical properties of fly ash

Properties	Experimental values	IS:3812-2003
Fineness, m^2/kg	290	
Bulk density, g/cc	1.16	
Colour	Cream White	
Specific gravity	2.08	
Oxide composition (% by mass)		
Silica (SiO_2)	52.0	
Iron oxide (Fe_2O_3)	4.0	
Calcium oxide (CaO)	1.3	Within limits
Magnesium oxide (MgO)	0.80	
Potassium oxide (K_2O)	0.82	
Titanium oxide (TiO_2)	0.28	
Aluminium oxide (Al_2O_3)	33.8	
Loss of ignition(LOI)	1.46	
Alkali oxide	0.39	
Sulphur Oxide	1.46	

Figure 3.1 fly ash

3.1 Ground granulated blast furnace slag (GGBS)

GGBS is a by-product of iron production. Figure 3.2, shows the appearance of GGBS. The GGBS is replaced with FA to obtain strength in ambient curing.

Table 3.2 Physical and chemical properties of GGBS

Oxide composition (% by mass)		
Silica (SiO_2)	35	
Iron oxide (Fe_2O_3)	1.3	70 min
Aluminium oxide (Al_2O_3)	10	
Calcium oxide (CaO)	40.3	45
Magnesium oxide (MgO)	8	17.0 max
Sulphide Sulphur	2.93	2 max
Phosphorous	0.6	within limits
Alkali oxide	0.15	1.5 max
Loss of ignition (LOI)	1.80	12 max

Figure 3.2 Ground granulated blast furnace slag (GGBS)

3.2 Sodium hydroxide

The appearance of NaOH is shown in figure 3.3. Its properties are as given in the table (3.3). Solution is prepared by adding water to the flakes based on the molarity conditions.

Table 3.3 Physical and chemical properties of Sodium hydroxide

Appearance	Solution
Colour	White colourless
Specific gravity	1.16
Assay	96-98%

*Supplied by Manufacturer

Figure 3.3 Sodium hydroxide

3.3 Sodium silicate

Generally, Na_2SiO_3 is available in liquid (gel) form as revealed figure 3.4. The ratio of SiO_2 to Na_2O is 2.2. The specification details of the Na_2SiO_3 solution are given in table 3.4.

Table 3.4 Properties of sodium silicate

Chemical formula	Na_2SiO_3
Na_2O	14.70%
SiO_2	29.40%
Water	55.90%
Appearance	Liquid (gel)
Colour	Light yellow liquid
Specific gravity	1.57

* Supplied by Manufacturer

Figure 3.4 Sodium silicate

3.4 Super plasticizer

In order to improve the workability of fresh geopolymer concrete, high-range water reducing naphthalene based super plasticizer (Conplast SP430) was added during the concrete mixing.

3.5 Aggregates

3.5.1 Fine Aggregate

In the present investigations Fine Aggregate used is of natural sand obtained from local market. Sand was confirming to zone II as per IS 383:1970. The properties of Fine Aggregates and the details of test results are tabulated in the Table 3.5 and Table 3.6

Table 3.5 Physical Properties of Fine Aggregate

S.No.	Properties of FA tested	Test result
1	Specific gravity	2.5
2	Fineness modulus	2.12
3	Water absorption	0.50%
4	Silt content	3%

3.5.1 Coarse Aggregate

Locally available Crushed granite stones of size 20mm and 10mm were used as coarse aggregate. The properties of Coarse Aggregates and the details of test results are as tabulated in the Table 3.7 and Table 3.8

Table 3.6 Properties of Coarse Aggregate

S.No.	Properties of CA tested	Test result
1	Specific gravity	2.6
2	Fineness modulus	6.9
3	Water absorption	0.50%

IV. RESULTS AND DISCUSSION

4.1 General

All of the observations made during the experimental programme have been meticulously tabulated. For easier understanding, the test results are presented in both table and graphical form. All of the test results are included in this chapter in the various formats described above.

Both steel and Recron 3 fibres were used in the test. These fibres were purchased at a nearby market. The compressive strength, flexural strength, and split tensile strengths are examined in light of the findings of the experimental tests.

4.2. Properties of fresh concrete

4.2.1 Workability

Employing the slump test and the compaction factor test, the workability of freshly mixed concrete is determined.

4.2.1.1 Slump test

Table 4.1 Slump Values of RGPC

Mix ID	% of Recron fiber	GPC M30 grade concrete
		Slump (mm)
G_1	**0**	**80**
R1	0.2	75
R2	0.4	60
R3	0.60	50
R4	0.8	45
R5	1.0	40

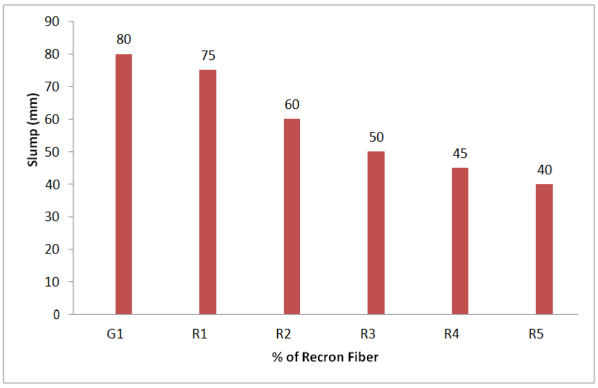


Fig 4.1: Slump v/s Recron 3s

The figure 4.1 shows the slump v/s variations of Recron3s in GPC. Table 4.1 displays the results of the slump tests conducted on the fresh concrete mixtures. Test Results reveals that concrete without fiber have maximum slump value (80mm) whereas concrete with R1 fiber have slump value of 75mm and followed by 60mm, 50mm, 45mm for decrease in fiber content from R2 to R5. The slump test results conclude that the workability decreases as percentage of Recron 3s increase. As the amount of fiber increases, the slump values decrease; this may be due to increased high fiber volume fraction at the constant water level.

Table 4.2 Slump Values SGPC

Mix ID	% Of Steel fiber	GPC M30 grade concrete
		Slump (mm)
G_1	0	80
S1	0.2	78
S2	0.4	76
S3	0.60	73
S4	0.8	71
S5	1.0	68
S6	1.2	66
S7	1.4	65
S8	1.6	63
S9	1.8	60
S10	2.0	58
S11	2.5	51
S12	3.0	46
S13	3.5	40

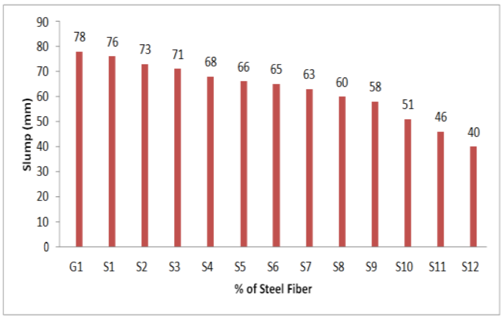


Fig 4.2: Slump v/s Steel fiber

The figure 4.2 shows the slump v/s variations of steel fiber with GPC. The test results for SGPC are given in table 4.2. Results reveals that concrete without fiber have maximum slump value 80mm whereas concrete with S1 fiber have slump value of 78mm, followed by 76mm, 73mm, 71mm, 68mm, 66 mm, 65mm, 63mm, 60mm, 58mm, 51mm, 46mm, 40mm decrease infiber content from S1 to S13. As the amount of fiber increases, the slump values decreases; this may be due to increased solid state at the constant water level.

Table 4.3 Slump Values of blended fiber dosage with GPC

Mix ID	% of Recron	% of Steel	GPC M30 grade concrete
			Slump (mm)
RF_1SF_1	0.2	**0.5**	**68**
RF_1SF_2		1	61
RF_1SF_3		1.5	55
RF_1SF_4		2	40
RF_2SF_1	0.4	**0.5**	**60**
RF_2SF_2		1	52
RF_2SF_3		1.5	48
RF_2SF_4		2	45
RF_3SF_1	0.6	**0.5**	**53**
RF_3SF_2		1	47
RF_3SF_3		1.5	40
RF_3SF_4		2	40

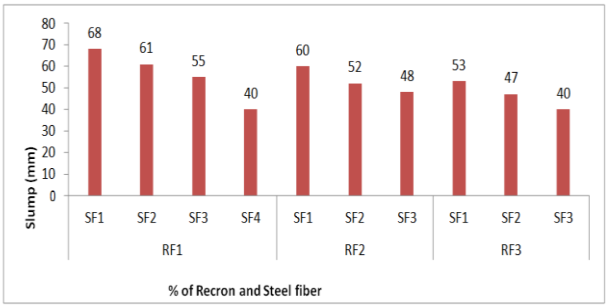


Fig 4.3: Slump v/s blended fiber dosage

The figure 4.3 shows the slump v/s blended fiber dosage in GPC. The slump test results obtained are given in table 4.3. Results reveals that concrete without fiber have maximum slump value 80mm whereas with blended fiber of RF1SF1 have highest slump value 68mm, whereas concrete with contact RF1 and variations of SF1, SF2 SF3 and SF4 fiber have slump value are 61mm, 55mm, 40mm. With the blended fiber of RF2SF1 have highest slump value 60mm, whereas concrete with contact RF2 and variations of SF1, SF2, and SF3 fiber have slumpvalue are 52mm, and 48mm. With the blended fiber of

RF3SF1 have highest slump value 53mm, whereas concrete with contact RF3 and variations of SF1, SF2, and SF3 fiber have slump value are 47mm, and The slump test results conclude that the workability decrease as percentage of Steel and Recron fiber goes on increasing in the concrete mix.

V. SUMMARY AND CONCLUSIONS

5.1 Summary

The Fibers of Recron, steel in Geopolymer concrete shown improvement in CS and FS and TS based on experiments done the following conclusions were arrived.

CONCLUSIONS

1. From the CS results, the optimum percentage of Recron fiber recommended is 0.6%. The CS increases 18.18% over controlled concrete up to the 0.6% after that strength decreases. It indicates that 0.6% is optimum dosage up to which all the voids are effectively filled.
2. From the CS results, the optimum percentage of steel fiber recommended is 2.5%. The CS increases 19.01% over controlled concrete up to the 2.5% after that strength decreases. Again, it can be concluded that optimum dosage of steel is 2.5% after that addition steel fiber mix will become very stiff to work with.
3. In three different blended fiber dosages i.,e RF1 SF3(0.2,1.5), , RF2SF2(0.4,1), and RF3SF2(0.6,0.5), optimum blended fiber dosage is RF2SF2(0.4,1) increase in CS 22.23%, 21.14%, and 24.57% respectively over controlled concrete
4. Mechanical properties for optimum dosage of Recron 0.6% the CS, FS and TS increased by 18.18%, 17.80% and 20.75% respectively over controlled concrete.
5. Mechanical properties for optimum steel dosage of 2.5% the CS and FS and TS increased by 19.01%, 18.94% and 22.45% respectively over controlled concrete.
6. For optimum blended dosage of RF2SF2 CS and FS and TS increased by 22.23%, 21.14% and 24.57% respectively over controlled concrete. Overall increase in mechanical properties more strength is observed blended fiber dosage of RF2SF2. Hence this is taken as optimum blended fiber dosage.
7. Blended fiber GPC is provided economical compared with individual fiber.
8. The blended fiber reinforced GPC is showing improvement in the flexural strength compared with individual fiber.
9. The mass due to Sulphuric acid attack on GPC after the addition of the RF3SF4 the weight is increased with 0.933%.
10. The CS due to Sulphuric acid attack on GPC after the addition of the RF3SF3 is increased with

9.24%.

11. The mass due to Sodium chloride attack on GPC after the addition of the RF3SF3 the weight is increased with 0.91%.
12. The CS due to Sodium chloride attack on GPC after the addition of the RF3SF3 is increased with 4.8%.

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