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Partial Replacement of cement with GGBS in fiber reinforced concrete

Valeti Ravikumar[1] ,B J N Satish[2],Akkineni lakshmi Sindhu[3],Ganguluri Manideepthi[4]
[1]*PG Student, Department of structural enginnering& vignan deemed to be university,valetiravi55@gmail.com*
[2]*Assstant Professor, Department of Civil engineering & vignan deemed to be university, satishbjnvignan@gmail.com*
[3]*PG Student, Department of structural engineering & vignan deemed to be university, sindhu.akkineni558@gmail.com*
[4]*PG Student,Department of structural engineering & vignan deemed to be university, manideepthi.ganguluri@gmail.com*

Abstract— Concrete is globally used material.Concrete is broadly utilized in structural engineering with its high compressive strength, minimum cost and abudantly used raw material. But commonly concrete has mainly two insufficiencies, a low elasticity and a low resist fracture.To defeat this World wide a lot of research is currently being conducted concerning the use of fiber reinforced concrete, This research aims at providing the fibers which are eco-friendly . Mainly the two fibers selected for this reserch are Banana fiber and Jute fiber as they are natural fibers,they are eco-friendy and cost efficient.In this research different percentages of banana fiber and jute fiber having 20mm length were added to the total concrete ,and also to improve the comressive strength, cement is replaced partially with GGBS . M40 grade of concrete mix is used And To Determine the optimum percentage of each fiber and GGBS.

Keywords— Banana fiber,Jute fiber,GGBS.

INTRODUCTION

From ancient times concrete have been altered with the numerous kinds of materials to enhance their physical, mechanical, and synthetic properties. Today construction techonology development innovation has created through different tests and examinations to enhance the quality and strength of cement. In this respects different rnatural fibers are used as an alternative to the concrete for diminishing weight of cement and in addition cost of construction.Current investigate has built up another idea to expand the concrete ductility and its energy absorption capacity, and to improve overall durability by utilizing fibers.Fibres can be in type of coconut fiber, banana fiber, steel fiber, glass fiber, common fiber , manufactured fiber, and so on. The fibers are utilized to lessen shrinkage breaking. Fundamental part of fibers is to connect the breaks that create in cement and to increase the ductility of concrete element and post cracking behaviour of concrete.

Advantages of Fiber in Concrete:

- Fibre in concrete is suited to limit cavitation erosion in structures, for example,sluice ways,navigational locks and scaffold docks where high speed streams are experienced additionally maintain a strategic distance from catastrophic failures in bridges.
- In the earthquake prone areas the utilization of fiber strengthened concrete would positively limit the human casualities.
- Addition of fiber in concrete has begun to discover its place in numerous regions of civil infrastructure applications where the requirement for repairing, expanded durability additionally maintain a distance to avoid the corrosion at maximum.

MATERIALS

A. Cement

Standard Portland cement of 53 grade is utilized for the present investigation. The properties of this concrete have been tested are :

Specific gravity of cement	=	3.16
Initial setting time	=	40 min
Final setting time	=	480 min

B. Coarse Aggregate

Total aggregate must be equivalent to or superior to the hardened cement to withstand the design loads and the impacts of weathering. The properties of this coarse total have been tested and given underneath:

Specific gravity = 2.9

Water absorption = 1.5%

C. Fine Aggregate

Characteristic River sand was utilized as a part of setting up the concrete as it was locally available in sand quarry.

Specific gravity = 2.5

Water absorption = 2.5%

D. Water

Water available in laboratory.

E. Banana Fiber

Banana Fiber is a one of the most generally used regular fiber. It has high quality, light weight, little stretching, imperviousness to fire and strong moisture absorption. Banana fiber of length 40mm is utilized.

F. Jute Fiber

Jute fibres are taken out from the ribbon of the jute stem. This fibers are made from the most part out of the plant materials like cellulose and lignin. Jute is a standout amongst the most reasonable used natural fiber and second just to cotton in amount of production and variety of uses of vegetable fibers.

G. Super Plasticizer

ConplastSP430 IS is one of the best admixtures used to enhance the performance of concrete.Conplast SP430 is a chloride free, superplasticising admixture in light of chosen sulphonated napthalene polymers.

METHODOLOGY

The main philosophy included is to change the fibers with the particular percentages of jute and banana fiber and replacing of cement with GGBS with separate percentages.

- The specimens strength varying the level of banana fiber and keeping the jute fiber(0.1%referred from the journals) and GGBS(10% referred from the journals) rates as constant.
- The specimens strength vayring the level of jute fiber and keeping the level of banana fiber which gives high
- Strength from the varying percentages making it as consistent and GGBS rates as steady.
- The specimens strength vayring the level of GGBS and keeping the level of banana fiber which gives high strength from the varying percentages making it as consistent and level of jute fiber which gives high strength from the different percentages making it as steady.
- To determine the optimum percentages of each fiber and GGBS.

EXPERIMENTAL INVESTIGATION

Mix Proportions

Concrete mixture design involves in deciding the amount of cement,fine aggregate,coarse aggregate and water to get desired strength and workability.

In this project mix design ratio used is 1:2.10:3.25 M40 Grade Concrete

TABLE I - MIX PROPORTION

Cement	Chemical (kg)Admixture	CA (kg)	FA (kg)	W/c	Banana Fiber	Jute Fiber	GGBS
230.16	3.06	1330	776.4	0.4	6.75	2.9	153

Hardened Properties

A. Compressive Strength Test

a. The compressive strength results obtained obtained by varying banana fiber and keeping jute fiber and GGBS as constant.

Fig. 1 Compression testing machine

TABLE II

COMPRESSION TESTING RESULTS

S. no	Percentages (%)			Compresive Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.1	0.1	10	27	36.16
2	0.25	0.1	10	30.14	40.13
3	0.5	0.1	10	32	42.80
4	0.75	0.1	10	31.04	40.92
5	1	0.1	10	0	0

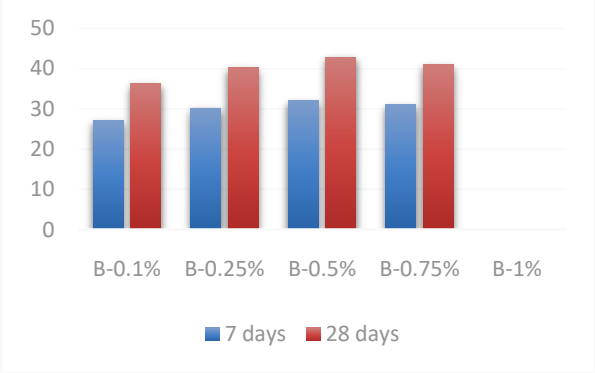

Fig .2 Compressive strength of varying banana fiber

b. The compressive strength results obtained obtained by varying jute fiber and keeping banana fiber and GGBS as constant.

TABLE III

COMPRESSION TESTING RESULTS

S no	Percentages (%)			Compressive Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.5	0.075	10	28.96	37.6
2	0.5	0.1	10	31.52	41.23
3	0.5	0.15	10	32.91	42.86
4	0.5	0.2	10	33.10	44.97
5	0.5	0.25	10	32.16	43.12

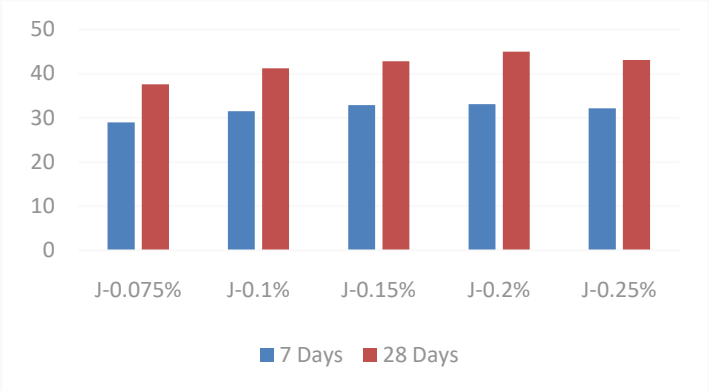

Fig.3 Compressive strength of varying jute fiber

c. The compressive strength results obtained obtained by varying GGBS and keeping banana fiber and Jute fiber as constant.

TABLE IV

COMPRESSION TESTING RESULTS

S. no	Percentages (%)			Compressive Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.5	0.2	10	27.59	37.61
2	0.5	0.2	20	29.62	39.88
3	0.5	0.2	30	30.12	42.45
4	0.5	0.2	40	32.43	44.26
5	0.5	0.2	50	33.85	45.08

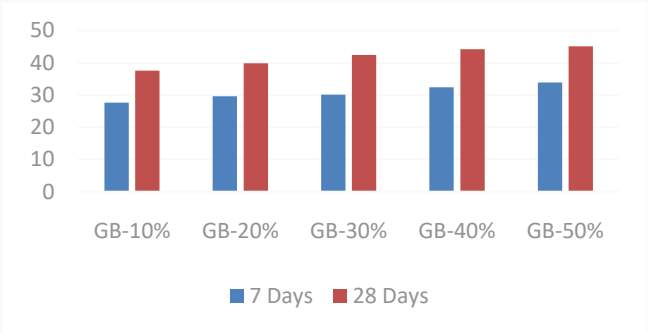

Fig.4 Compressive strength of varying GGBS

B. Split Tensile Strength Test

a. The split tensile strength results obtained obtained by varying banana fiber and keeping jute fiber and GGBS as constant.

Fig.5 Split tensile testing machine

TABLE V
SPLIT TENSILE TESTING RESULTS

S. no	Percentages (%)			Split. Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.1	0.1	10	2.96	4.25
2	0.25	0.1	10	4.12	6.10
3	0.5	0.1	10	6.89	8.02
4	0.75	0.1	10	4.93	7.56
5	1	0.1	10	1.54	2.13

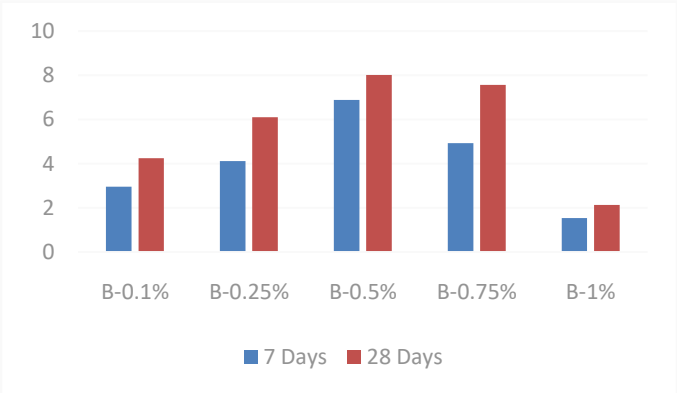

Fig.6 Split tensile strength of varying banana fiber

b. The split tensile strength results obtained obtained by varying jute fiber and keeping banana fiber and GGBS as constant.

TABLE VI
SPLIT TENSILE TESTING RESULTS

S. no	Percentages (%)			Comp. Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.5	0.075	10	1.98	5.26
2	0.5	0.1	10	2.65	6.40
3	0.5	0.15	10	3.98	6.96
4	0.5	0.2	10	4.23	8.92
5	0.5	0.25	10	4.23	8.51

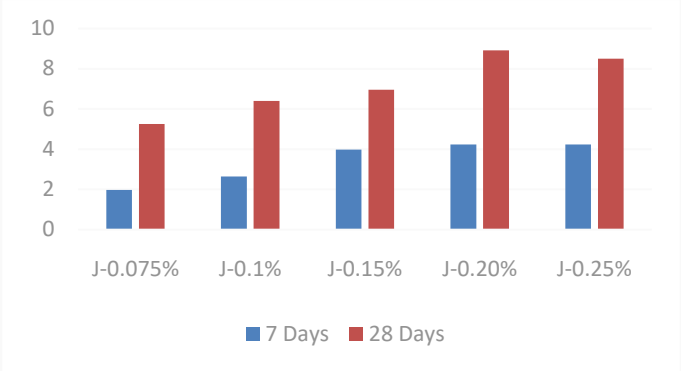

Fig.7 Split tensile strength of varying jute fiber

c. The split tensile strength results obtained obtained by varying GGBS and keeping jute fiber and banana fiber as constant.

TABLE VII
SPLIT TENSILE TESTING RESULTS

S. no	Percentages (%)			Comp. Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.5	0.2	10	4.21	8.92
2	0.5	0.2	20	4.06	8.41
3	0.5	0.2	30	3.76	7.95
4	0.5	0.2	40	3.52	7.66
5	0.5	0.2	50	3.21	7.25

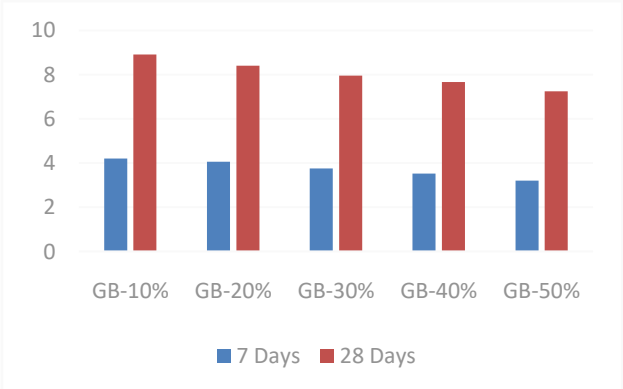

Fig.8 Spit tensile strength of varying GGBS

C. Flexural Strength Test

a. The flexural strength results obtained obtained by varying banana fiber and keeping jute fiber and GGBS as constant.

Fig.9 flexural testing machine

TABLEVIII

FLEXURAL STRENGTH TESTING RESULTS

S. no	**Percentages (%)**			**Flexural. Strength (N/mm^2)**	
	Banana fiber	**Jute fiber**	**GGBS**	**7 days**	**28 days**
1	0.1	0.1	10	1.88	4.01
2	0.25	0.1	10	2.23	4.58
3	0.5	0.1	10	3.00	5.12
4	0.75	0.1	10	3.64	6.21
5	1	0.1	10	3.41	5.89

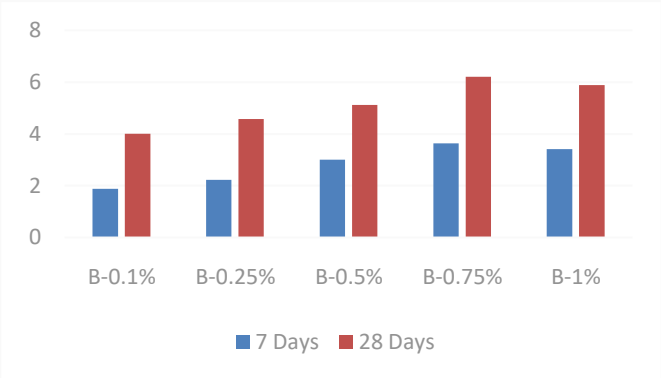

Fig.10 Flexural strength of varying banana fiber

b. The flexural strength results obtained obtained by varying jute fiber and keeping banana fiber and GGBS as constant.

TABLE IX
FLEXURAL STRENGTH TESTING RESULTS

S. no	Percentages (%)			Flexural. Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.5	0.075	10	2.69	4.54
2	0.5	0.1	10	3.02	5.13
3	0.5	0.15	10	3.43	5.55
4	0.5	0.2	10	3.50	5.84
5	0.5	0.25	10	3.48	5.76

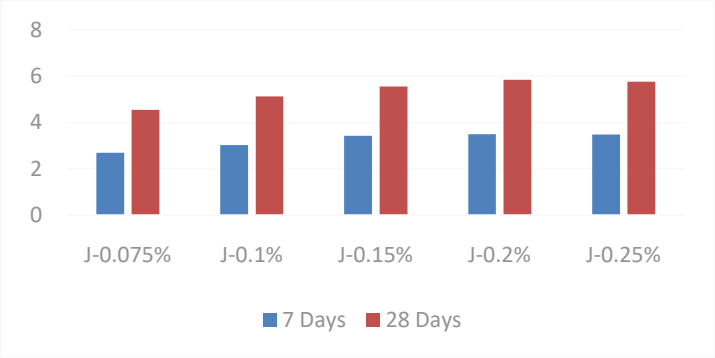

Fig.11 Flexural strength of varying jute fiber

c. The flexural strength results obtained obtained by varying GGBS and keeping jute fiber and banana fiber as constant.

TABLE X
FLEXURAL STRENGTH TESTING RESULTS

S. no	Percentages (%)			Flexural. Strength (N/mm^2)	
	Banana fiber	Jute fiber	GGBS	7 days	28 days
1	0.5	0.2	10	3.48	5.83
2	0.5	0.2	20	3.51	5.98
3	0.5	0.2	30	3.48	5.90
4	0.5	0.2	40	3.39	5.52
5	0.5	0.2	50	3.12	5.23

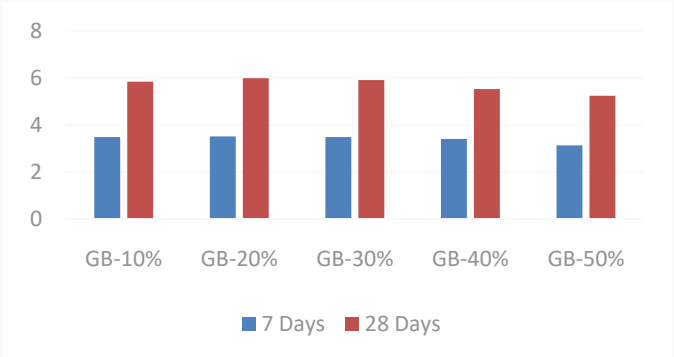

Fig.12 Flexural strength of varying GGBS

CONCLUSIONS

- From the results obtained from table 4.1 the compressive strength and split tensile strength increases with the percentage of banana fiber at 0.5% and later it gradually decreases and keeping jute fiber and GGBS as constant
- from table 4.2 the compressive strength and split tensile strength increases with the percentage of jute fiber at 0.2% and later it gradually decreases and keeping banana fiber and GGBS as constant but from table 4.6 the split tensile strength wtih varying GGBS the strength gradually decreases
- from table 4.3 the compressive strength and split tensile strength increases with the percentage of GGBS at 40% and later it gradually decreases and keeping banana fiber and jute fiber as constant.
- The flexural strength also increases gradually with banana fiber at 0.075% and jute fiber at 0.2% same and GGBS at 40% same.
- The maximum strength shown by fibers is at pecentages of banana at 0.5%,j ute fiber is at 0.2% and ggbs at 40%.

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