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Utilization of Coconut Fiber in Concrete

Sonu Kumar Soni[1], Mr. Vagesh Kumar[2] and Mr. Sanjeev Jangde[3]

[1] M. Tech Scholar ISBM University, Gariyaband, Chhattisgarh, india, Pin- 493996 Sonusonisk444@gmail.com ; Tel.: +918319080942
[2] Assistant Professor, ISBM University, Gariyaband, (C.G), India -493996 Vageshkumbhakar99@gmail.com; Tel: 9575220287
[3]Assistant Professor, ISBM University, Gariyaband, (C.G), India -493996 sanjeevjangde717@gmail.com; Tel: 8085036150

ABSTRACT

As we all know that concrete fails suddenly under tension & crack excessively when under reinforced. Since we all know India is a tropical country & in tropical regions natural fibers are abundantly available which are utilized will reduce cost of construction & improve performance.

Coconut fiber is an abundant, versatile, renewable, cheap, lignocelluloses fiber and more resistant to thermal conductivity. The aim of investigation is to study the possibilities to use the coconut fiber in addition to the other constituents of concrete and to study the strength properties. A literature survey was carried out, which indicates that the detailed investigation of coconut fiber concrete is necessary. In the present study the deformation properties of concrete beams with fibers under static loading condition and the behavior of structural components in terms of compressive strength for plain concrete(PC) and coconut fiber reinforced concrete(CFRC) has been studied.

This projectintroduces the use of coconut fiber in concrete. Coconut fibers were extracted from coconut & chopped in 40mm length. Concrete of mix ratio 1:1.5:3 was produced which contains 1, 1.5,and 2 % by weight of cement. The water cement ratio is taken as0.6. Compressive strength wasdetermined by CTM after curing ages of 7 & 28 days.The result showed that 1-1.5% fiber gives more compressive strength , it also observe that heat of hydration is less & due to this cracks are less or minute hair cracks as compared to conventional concrete . Concrete is also find ecofriendly because in this we use waste material & generate less heat during chemical reaction.

1. Introduction:

Concrete is the most widely used construction material in civil engineering industry because of its high structural strength, stability, and malleability. Recent technological developments have shown that these materials can be used as valuable inorganic and organic resources to produce various useful value-added products.

To meet the requirements of globalization, in the construction of buildings and other structures concrete plays the rightful role and a large quantum of concrete is being utilized. River sand, which is one of the constituents used in the production of conventional concrete, has become highly expensive and also scarce. In the backdrop of such a bleak atmosphere, there is large demand for alternative materials from agricultural waste.

It is the most used man made construction material in the world, & second only to water as the most utilized substance on the planet .So we can say concrete has a vital importance in our life, if we use our natural resources to make the concrete one day it definitely end. So we must find an alternate source or such things which at least reduce the amount of cement. That's why we introduce coconut fiber with lots of good qualities.

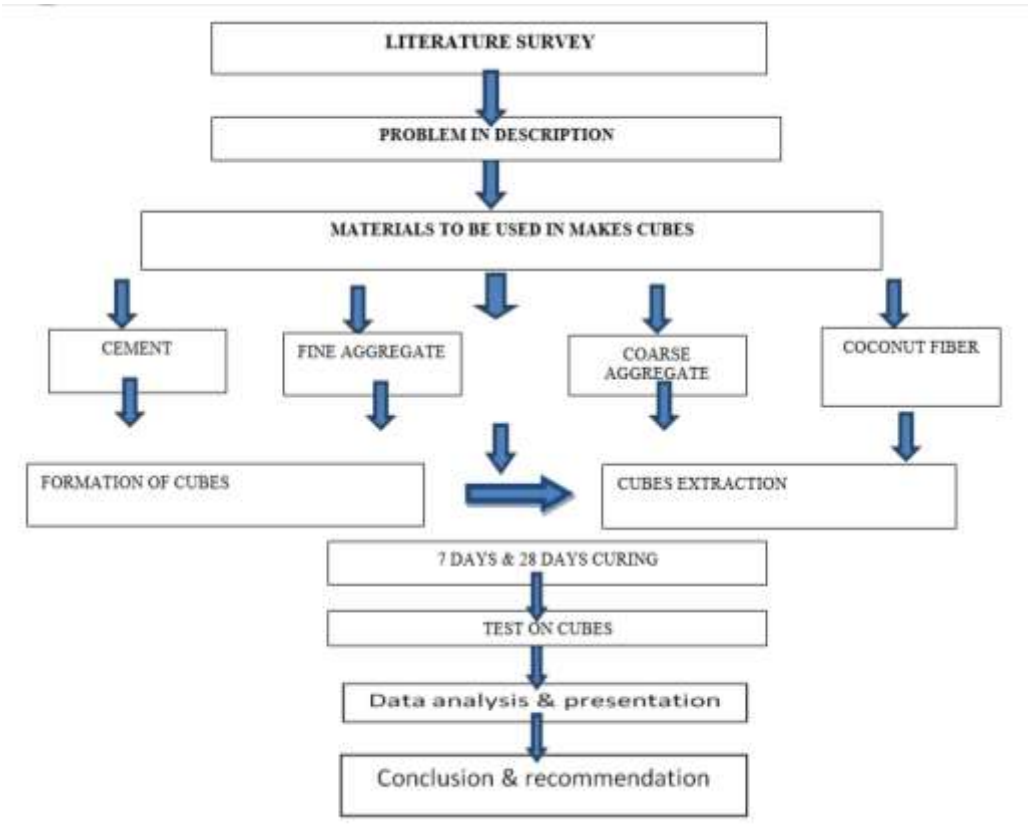
The use of coconut fiber is increasing every year in worldwide. India is one of the largest country in population exceeds 125cr. & more than 70% people lives in village & depends upon agricultural . Every year the agricultural waste increases specially fiber type waste increases this creates a major problem for the earth and their livings. For this issue, the easiest and cheapest way of decomposing of the fiber is by using in concrete. Its also benefit the peasant &boost our economy . To overcome the brittle response of the concrete. Micro structural properties of natural fibers as composites in terms of flexibility, ductility and energy absorption improve seismic resistance. Application of Fiber Reinforced Concrete (FRC) is continuously growing in various application fields.FRC is widely used in structures. Due to the property that fiber enhances toughness of concrete, FRC is used on large scale for structural purposes. It improves fatigue resistance makes crack pattern distributed

Objective

1. Sustainable. To check the compressive strength by adding different percentage of coconut fiber.
2. Comparison of strength by using coconut fiber as compared to conventional concrete.

3. To utilize the waste coconut fibers for making high performance concrete.
4. To use the waste for making environment

METHODOLOGY



Expected Outcome

1. Compressive strength can be increased.

2. Concrete must be workable.

3. Flexural strength should show satisfactory result.

4. Heat of hydration can also be reduced.

2. Literature Review

Fiber reinforced concrete was successfully used in variety of engineering applications, because of its satisfactory and outstanding performance in the industry and construction field .However, most of the engineers and researchers have think that how and why the fibers perform so successfully. So, to recognize the usage of fibers in concrete, in these last four decades, most of the researches were done on behavior of fiber reinforced concrete in pavements.

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The materials chosen for structural up gradation should not pollute the environment and endanger bioreserves. They should be accessible to the ordinary people and be low in monetary cost. Coconut fiber is an abundant, versatile, renewable, cheap, lignocellulosic fiber and more resistant to thermal conductivity. The aim of investigation is to study the possibilities to use the coconut fiber in addition to the other constituents of concrete and to study the strength properties. A literature survey was carried out, which indicates that the detailed investigation of coconut fiber concrete is necessary. In the present study the deformation properties of concrete beams with fibers under static loading condition and the behavior of structural components in terms of compressive strength for plain concrete(PC) and coconut fiber reinforced concrete(CFRC) has been studied.

Optimum results were found when 2% of coir by weight of cement fibers were used, there was 6% and 13% increase in compressive strength as compared to normal concrete for 75AR and 125 AR respectively. **Patil Amaresh S et al**[(2)]has donethe work on steel fiber Reinforced concreteHe analyzed the reinforced with steel fibers for temperature stresses under Static load.

analysis.**KumarRakesh et al**[(3)]has reported the work on addition ofcoconut fiber discrete and fibrillated fibreon the properties of a grade concrete mixof 20 MPa compressive strength at 28-day. Sixconcrete mixes with fiber dosages 1 ,1.5, 2%and by weight fraction besides thecontrol concrete mix were manufactured.Discrete and fibrillated coconut fiber wasused in his study. The properties such assettlement, compressive strength, dryingshrinkage, and abrasion resistance of theconcrete were evaluated. The study suggested asignificant reduction in settlement and dryingshrinkage without significant change in compressive strength for the concrete mixes reinforced with Fibers in concrete serve as crack arrestor which can create a stage of slow crack propagation and gradual failure. The use of natural Fibers is economical as compared to synthetic fibers.

3. Materials Used:-

- Coconut Fiber - Coconut fiber is a fibrous material found in the fibrous husk (mesocarp) of the coconut (Cocos nucifera) of the coconut palm, which belongs to the palm family (Palmae). Due to its high lignin and low cellulose content, coconut fiber is durable and strong. This coconut can fiber be used in the concrete which is very important part of any construction. Normally, in convectional reinforced concrete we use steel bars which increase the weight as well as the cost of the concrete which cannot be easily affordable to all rulers as well as urban civilians.
- Cement- Cement is well – known building material and has occupied an indispensible place in construction works. There are a variety of cements available in the market and each type is use under certain conditions due to its special properties.
- Aggregates -Aggregates are inert granular materials such as sand, gravel, or crushed stone that, along with water and portland cement, are an essential ingredient in concrete.
- For a good concrete mix, aggregates need to be clean, hard, strong particles free of absorbed chemicals or coatings of clay and other fine materials that could cause the deterioration of concrete. Aggregates, which account for 60 to 75 percent of the total volume of concrete, are divided into two distinct categories--fine and coarse. Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 3/8-inch sieve. Coarse aggregates are any particles greater than 0.19 inch, but generally range between 3/8 and 1.5 inches in diameter. Gravels constitute the majority of coarse aggregate used in concrete with crushed stone making up most of the remainder.Natural gravel and sand are usually dug or dredged from a pit, river, lake, or seabed. Crushed aggregate is produced by crushing quarry rock, boulders, cobbles, or large size gravel. Recycled concrete is a viable source of aggregate and has been satisfactorily used in granular subbases, soil-cement, and in new concrete.

Sample collection

We have collected the samples from the nearby sites where the construction and destruction work was in process for new projects. We have also taken the samples present in our college campus and some amount from our experimental lab where we perform the work.

Samples which have been collected are as follows:

Sand.

Cement.

Water

Aggregate

Coconut fiber

Coconut fiber- There is a temple nearby my house where devotees offer oblation coconut after removing fiber. So we find the coconut fiber from the temple after asking preist.

Other materials are available in lab.

Concrete mix proportion

The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required, strength, durability, and workability as economically as possible, is termed the concrete mix design. The proportioning of ingredient of concrete is governed by the required performance of concrete in 2 states, namely the plastic and the hardened states. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of workability, therefore, becomes of vital importance.

The compressive strength of hardened concrete which is generally considered to be an index of its other properties, depends upon many factors, e.g. quality and quantity of cement, water and aggregates; batching and mixing; placing, compaction and curing. The cost of concrete is made up of the cost

of materials, plant and labour. The variations in the cost of materials arise from the fact that the cement is several times costly than the aggregate, thus the aim is to produce as lean a mix as possible. From technical point of view the rich mixes may lead to high shrinkage and cracking in the structural concrete, and to evolution of high heat of hydration in mass concrete which may cause cracking.

The actual cost of concrete is related to the cost of materials required for producing a minimum mean strength called characteristic strength that is specified by the designer of the structure. This depends on the quality control measures, but there is no doubt that the quality control adds to the cost of concrete. The extent of quality control is often an economic compromise, and depends on the size and type of job. The cost of labour depends on the workability of mix, e.g., a concrete mix of inadequate workability may result in a high cost of labour to obtain a degree of compaction with available

Procedure

1. First of all fiber coconut are collected from the temple.
2. After the collection materials sieving now its time to weigh the materials according to the nominal mix design. The materials were taken according to the M20 grade.
3. Now, the final work starts of mixing we have to mix the various samples taken like cement, sand, aggregate and minerals coconut fiber are than mixed with required amount of water to obtain nominal concrete mix.
4. Then casting of cubes of size 150mm×150mm×150mm
5. At last we have performed the test of COMPRESSIVE STRENGTH

Experimental setup

Compression testing machine a universal tester is used to test the compressive strength of the materials. The “universal” name reflect that it can perform many standard tensile and compression test on materials, components and structures.

It is used in a way in this the specimen is the machine between the grip. Once the machine started it begins to apply the load on specimen. Throughout the test the control system and software record the load of the specimen.

Compressive strength is a capacity of a material to withstand loads tending to reduce size, as opposed to tensile strength, which withstand loads tending to elongate. Compressive strength can be measured by plotting applied force against deformation intesting machine. Some materials fracture at their compressive strength limit; other deforms irreversibly, so a given amount of deformation may be considered as the limit for compressive load.

Compressive strength is a key value for design structure.

In Procedure of compressive strength test

this test the samples prepared are filled in the moulds at the edge of the mould and then it is tamped with the help of the tamping rod.

Following moulds are used in the experiment they have a size of 150mm*150mm*150mm. after filling the cubes and tamped it properly, the cubes are prepared and now the prepared cubes are then kept in to curing tank for 7days and 28days to achieve their strength .After this time period the cubes are determine.

In this way we are able to calculate the compressive strength of the sample which was made by using the COCNUT FIBER.

TEST FOR WORKABILITY (SLUMP CONE TEST) (IS- 1199-1959)

SLUMP CONE TEST: -Concrete slump test is to determine the workability of concrete mix prepared at laboratory or construction site during the process of work. The slump test is the most simple workability test for concrete, involves low cost and provides immediate results.

EQUIPMENTS REQUIRED FOR CONCRETE SLUMP CONE TEST:-

1) Mould
2) Non porous plate
3) Measuring scale
4) Temping rod

PROCEDURE FOR CONCRETE SLUMP TEST

1) Clean the internal surface of the mould and apply oil.
2) Place the mould on a smooth horizontal non porous plate.
3) Fill the mould with the prepared concrete mix.

4) If concrete is self consolidate then no required to tamping.

5) Remove the excess concrete and level the surface with a trowel.

6) Clean away the mortar or water leaked out between the mould and the base plate.

7) Raise the mould from the concrete immediately and slowly in vertical direction.

8) Measure the slump as the difference between the height of the mould and that of height point of the specimen being tested.

RESULT OF CONCRETE SLUMP TEST

Slump for the given sample = …60……..mm

Flexural Strength of Coconut Fibre Reinforced Concrete

Flexural strength (or modulus of rupture) is one of the principal factors in concrete pavement design as it measures the resistance of the concrete to flexural force.

Coconut Fibre (CF) Content (%)	**Flexural Strength (N/mm^2)**	
	Curing Age (Days)	
	7	**28**
0	1.96	2.54
1	2.44	2.73
1.5	2.72	2.79
2	2.84	2.88

Results

Coconut chopped into 10mm length fiber

Taking 1% coconut by weight of cement compressive strength after 7 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	410	18.22
II	Sample 2	405	18.00
III	Sample 3	395	17.55

Average = 17.92N/ mm^2

Taking 1% coconut by weight of cement compressive strength after 14 days.

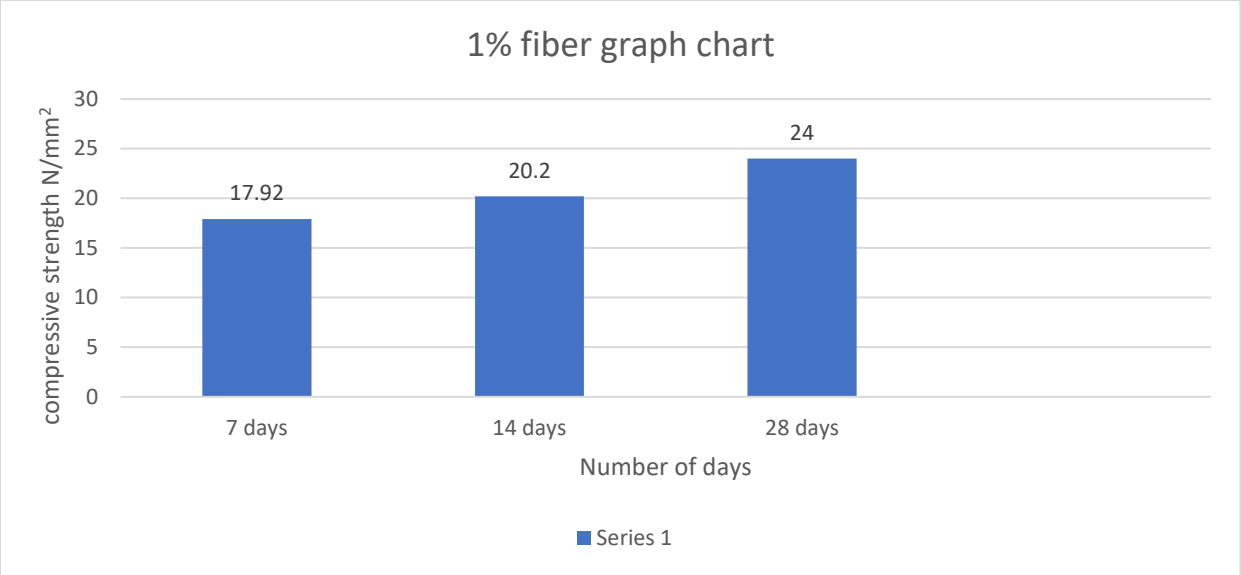
S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	465	20.66
II	Sample 2	460	20.44
III	Sample 3	440	19.55

Average = 20.20N/ mm^2

Taking 1% coconut by weight of cement compressive strength after 28 days

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	545	24.22
II	Sample 2	520	23.11
III	Sample 3	555	24.66

Average = 24.00N/ mm^2



Taking 2% coconut by weight of cement compressive strength after 7 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	375	16.66
II	Sample 2	385	17.11
III	Sample 3	390	17.33

Average =17.03 N/ mm^2

Taking 2% coconut by weight of cement compressive strength after 14 days.

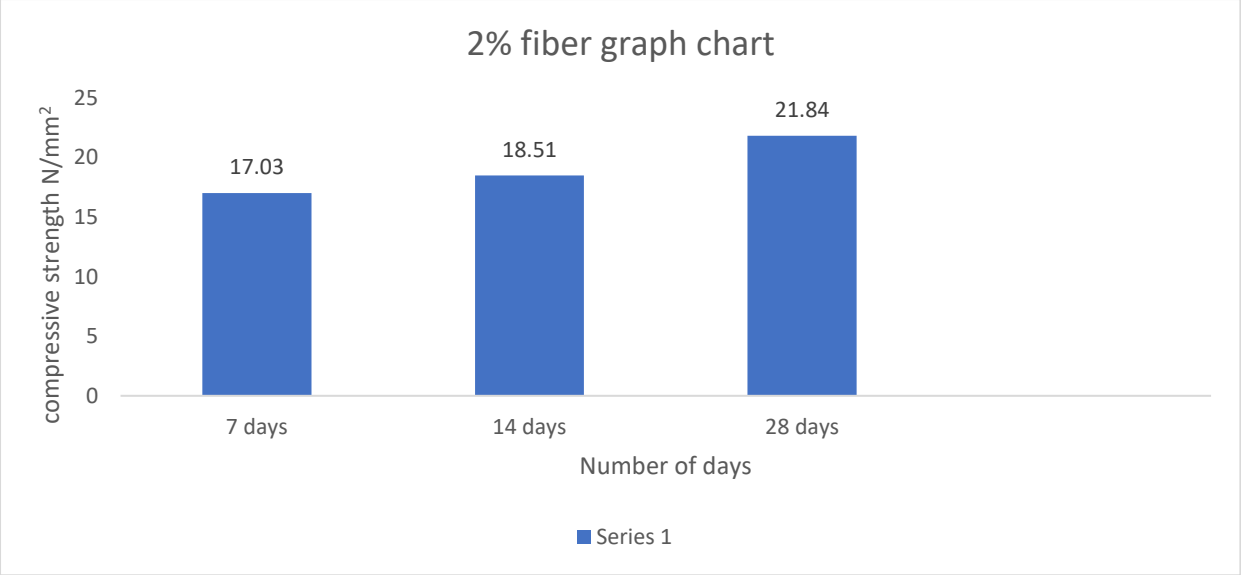
S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	405	18.00
II	Sample 2	435	19.33
III	Sample 3	410	18.22

Average = 18.51N/ mm^2

Taking 2% coconut by weight of cement compressive strength after 28 days

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	475	21.11
II	Sample 2	490	21.77
III	Sample 3	510	22.66

Average = 21.84N/ mm^2



Taking 1.5% coconut by weight of cement compressive strength after 7 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	410	18.22
II	Sample 2	430	19.11
III	Sample 3	395	17.55

Average = 18.29N/ mm^2

Taking 1.5% coconut by weight of cement compressive strength after 14 days.

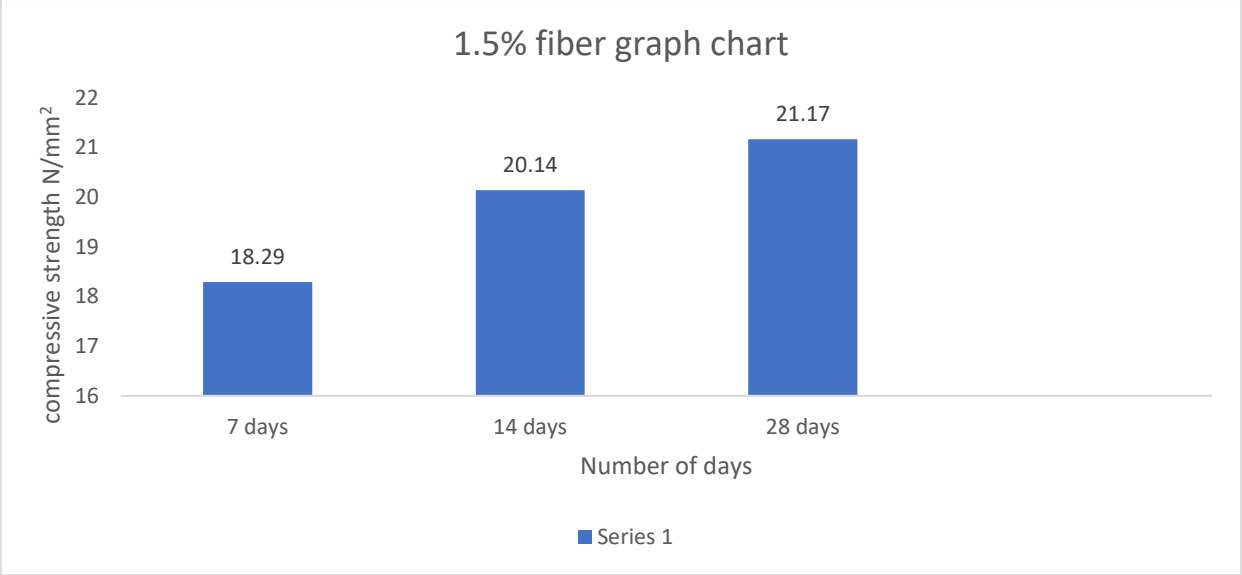
S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	465	20.66
II	Sample 2	455	20.22
III	Sample 3	440	19.55

Average = 20.14N/ mm^2

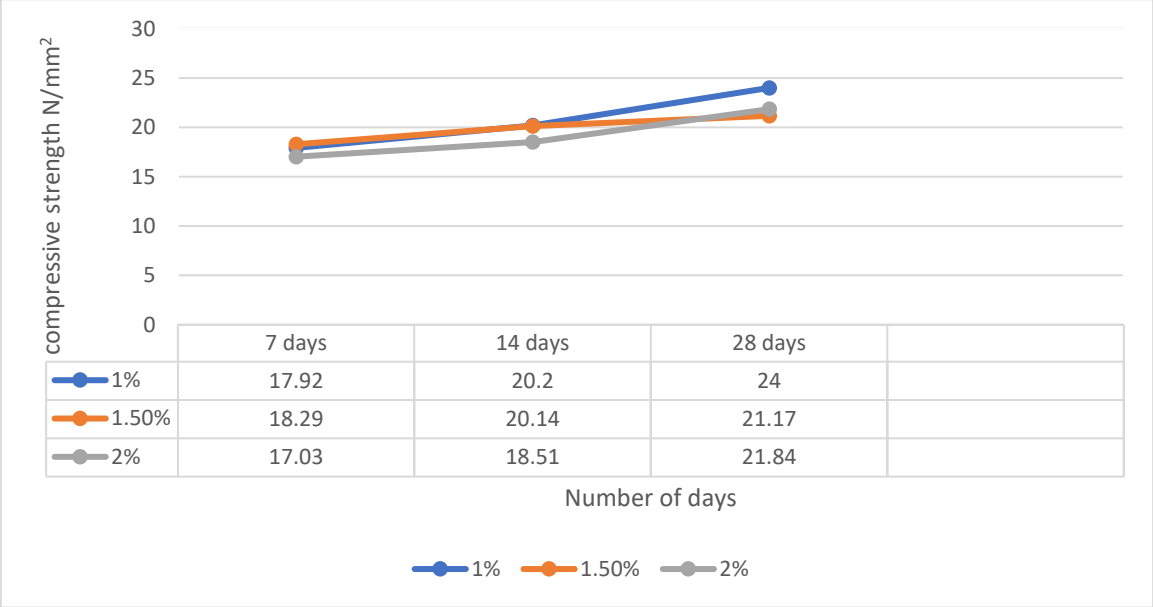
Taking 1.5% coconut by weight of cement compressive strength after 28 days

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	490	21.77
II	Sample 2	475	21.11
III	Sample 3	505	22.44

Average = 21.77N/ mm^2



Comparison between 1%, 1.5% and 2% coconut fiber by graph chart



Coconut chopped into 40mm length fiber

Taking 1% coconut by weight of cement compressive strength after 7 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	375	16.66
II	Sample 2	380	16.00
III	Sample 3	390	17.33

Average =16.67 N/ mm^2

Taking 1% coconut by weight of cement compressive strength after 14 days.

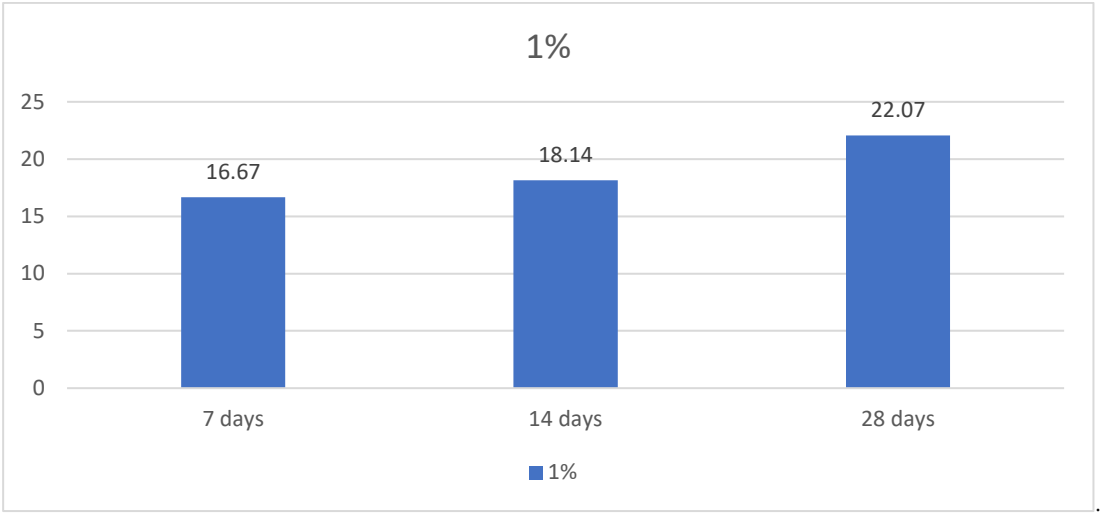
S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	400	17.78
II	Sample 2	415	18.44
III	Sample 3	410	18.22

Average = 18.14N/ mm^2

Taking 1% coconut by weight of cement compressive strength after 28 days

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	505	22.44
II	Sample 2	490	21.77
III	Sample 3	495	22.00

Average = 22.07N/ mm^2



Taking 1.5% coconut by weight of cement compressive strength after 7 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	360	16.00
II	Sample 2	365	16.22
III	Sample 3	370	16.44

Average = 16.22N/ mm^2

Taking 1.5% coconut by weight of cement compressive strength after 14 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	395	17.55
II	Sample 2	405	18.00
III	Sample 3	420	18.66

Average = 18.07N/ mm^2

Taking 1.5% coconut by weight of cement compressive strength after 28 days

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	480	21.33
II	Sample 2	475	21.11
III	Sample 3	480	21.33

Average = 21.25N/ mm^2

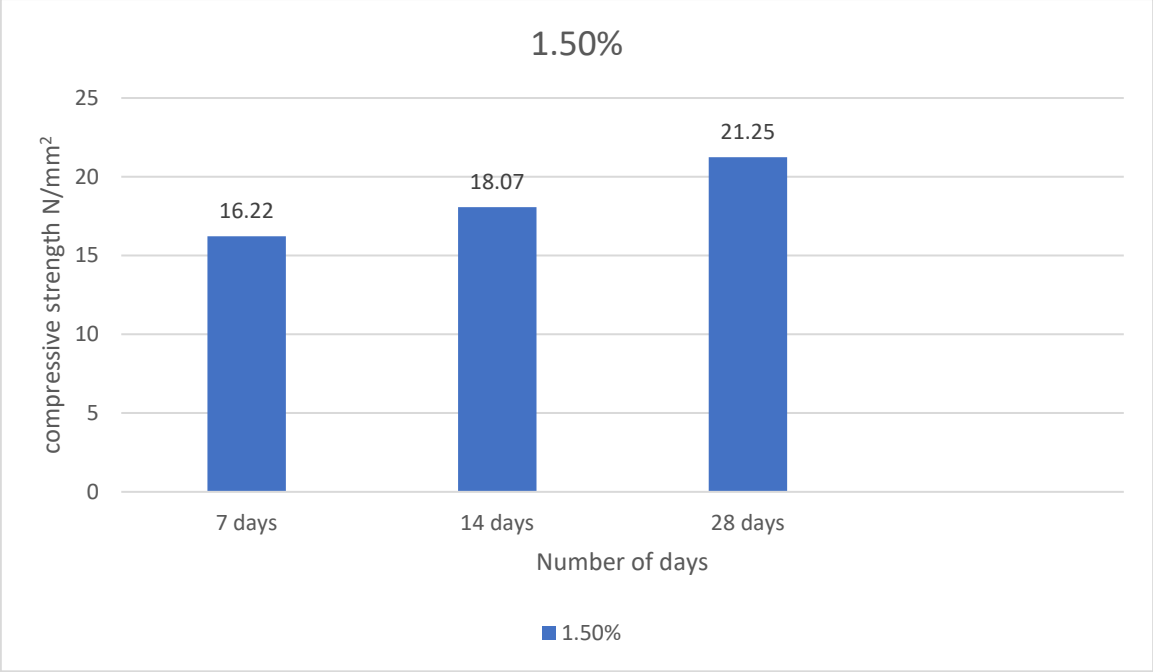


Table-20Taking 2% coconut by weight of cement compressive strength after 7 days.

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	375	16.66
II	Sample 2	365	16.22
III	Sample 3	355	15.77

Average =16.21 N/ mm^2

Table-21 Taking 2% coconut by weight of cement compressive strength after 14 days.

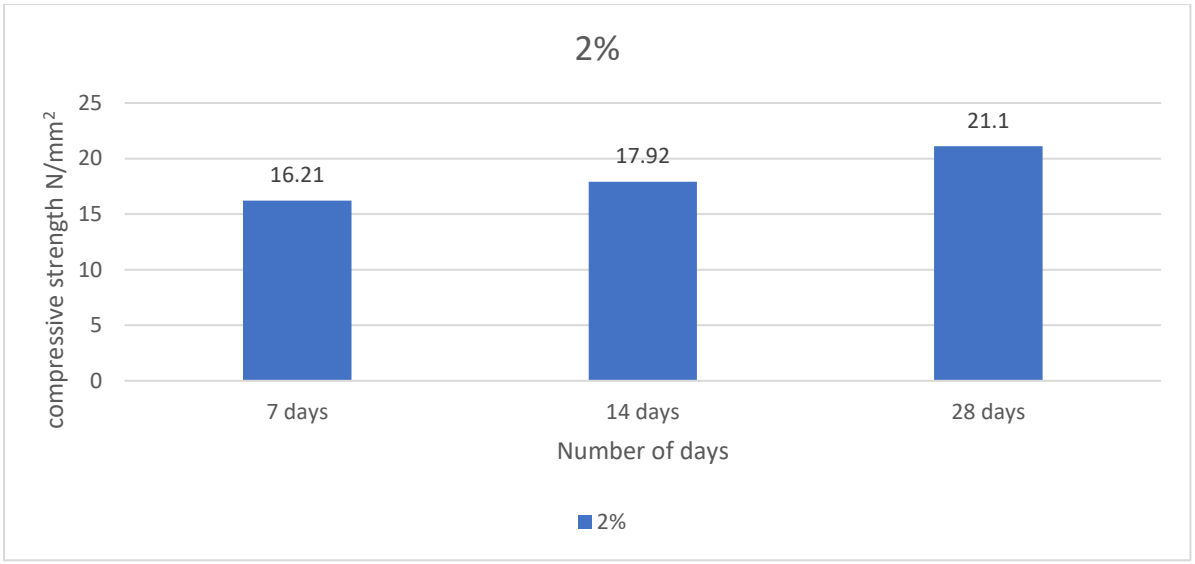
S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	405	18.00
II	Sample 2	395	17.55
III	Sample 3	410	18.22

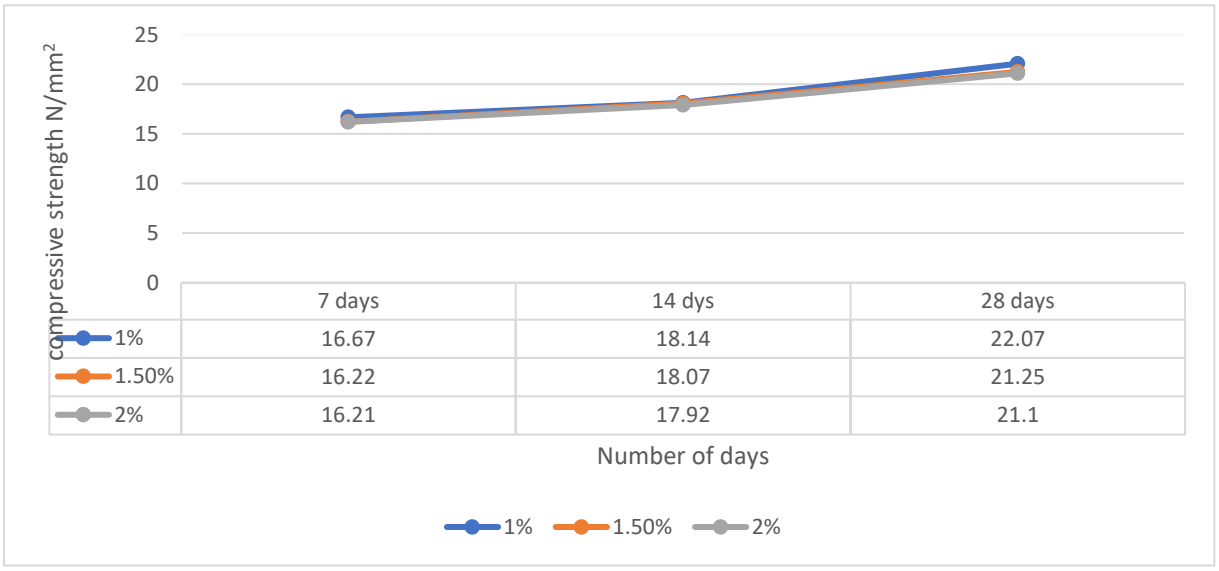
Average = 17.92N/ mm^2

Table-22Taking 2% coconut by weight of cement compressive strength after 28 days

S.no.	Sample Taken	Load (KN)	Compressive strength(N/mm^2)
I	Sample 1	475	21.11
II	Sample 2	470	20.88
III	Sample 3	480	21.33

Average = 21.10N/ mm^2





Comparison between 1%, 1.5%and 2% coconut fiber by graph chart

CONCLUSION:-

1. Compressive strength increased with age for all the mixes and reduced with increase in volume fraction of fibers except at 1% coconut fiber.

2.Use of coconut fiber in concrete can save our natural resources.

3.Concrete containing various fraction volume of CF has flexural strength higher than that of normal concrete at different ages only that the influence was not appreciable.

4.We concluded that the high performance concrete can be made by using coconut fiber.

5. It gives excellent flexural strength.

6. Waste of coconut fiber utilizes in this project.

7. Coconut fiber reduces heat of hydration.

8.The workability of concrete is satisfactory.