INFLUENCE OF COCONUT FIBRE ON PROPERTIES OF CONCRETE

A project

Submitted in partial fulfilment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

Under the supervision of

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MAY -2019

STUDENT'S DECLARATION

We hereby declare that the work presented in the Project report entitled **"INFLUENCE OF COCONUT FIBRE ON PROPERTIES OF CONCRETE"** submitted for partial fulfilment of the requirements for the degree of Bachelor of Technology in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of our work carried out under the supervision of **Prof. Ashok Kumar Gupta.** This work has not been submitted elsewhere for the reward of any other degree/diploma. We are fully responsible for the contents of our project report.

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6th May, 2019

CERTIFICATE

This is to certify that the work which is being presented in the project report titled **"Influence of Coconut Fibre on Properties Of Concrete"** in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Civil Engineering and submitted to the Department of Civil Engineering, **Jaypee University of Information Technology, Waknaghat** is an authentic record of work carried out by **Charu Gupta (151614) and Kuenzang SC Choden (151610)** during a period from July 2018 to May 2019 under the supervision of **Prof. Ashok Kumar Gupta,** Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat. The above statement made is correct to the best of our knowledge.

Date: …………………

Signature of Supervisor Dr. Ashok Kumar Gupta Professor and Head of Department Department of Civil Engineering JUIT, Waknaghat	Signature of HOD	Signature of External External Examiner

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ABSTRACT

The standard goal of this task is to examine the properties of fibre strengthened cement and plan the most efficient method to accomplish high compressive and rigidity. It is seen from the worldwide supportable advancements that strands like glass, coconut, carbon and steel filaments improves in rigidity, strength, shrinkage, solidness, disintegration opposition, crack and exhaustion properties of fibre strengthened cement. This additionally manages the variety of crack vitality of cement with option of coconut strands in various volumes. The utilization of this sustainable cement structure is helpful for devouring less vitality, discharging less green house gases into the air and costing less to assemble.

This investigation meant to examine the variety in quality of coconut fibre strengthened cement at different strands substance. The different quality dissected is the compressive and elasticity of the coconut fibre strengthened cements fluctuating volume rates (0.5%, 0.75%, 1% by weight of the concrete) of fibre. Typical cement is great in pressure yet feeble in strain. The shortcoming in strain can be overwhelmed by utilizing such strands. The benefits of utilizing coconut strands for the most part give a minimal effort development and the end of the requirement for waste transfer in landfills. Usage of coconut fibre in solid prompts a successful solids squander the board procedure.

Keywords: Tensile strength, Compressive strength, Coconut fibres.

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LIST OF SYMBOLS & ABBREVIATIONS

Symbols & Abbreviations	**Description**
kN	Kilo Newton
MPa	Mega Pascal
FRC	Fibre Reinforced Concrete
CA	Coarse Aggregate
FA	Fine Aggregate
F	Flexural strength
SFRC	Steel fibre reinforced concrete

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CHAPTER 1
INTRODUCTION

1.1 GENERAL

Coconut fibre is extracted from the outer shell of the coconut. There are two types of coconut fibre, first is brown fibre which is extracted from the matured coconut and second is white fibre which is extracted from immature coconuts. Brown fibres are thick, strong and have high abrasion resistance where as white fibres which are smoother, finer and weaker. Coconut fibres are available in three types- long fibres, relatively short fibres and mixed fibres. These types of fibres have different uses depending upon their requirements. Brown fibres are most widely used in engineering. Coconut fibre being low in density reduces the weight of the fibre reinforced concrete.

Coconut fibre being the most ductile among all natural fibre (Majid Ali et al., 2012) has the potential to be used as a reinforcement material in concrete. It is biodegradable so the impact on the environment will be minimal. This is also a way to dispose off the fibres which are derived as waste materials from coconut fibre based manufacturing units to produce high strength materials. They are also cheap, easily available and non abrasive in nature.

The advantages of using coconut fibres are they are of low cost, low density, reasonable specific strength, good thermal insulation, reduce wear and availability to be recycled with minimal impact on environment.

1.2 NEED FOR STUDY

Compare with plain concrete, coconut fibre inclusion improves the compressive stress and strain and flexural strength, deflection of the concrete effectively.

Since cement – based materials are well known insulator, another avenue for future research and product development would be the use of coconut fibre – cement composite for sound and heat insulation. The use of such fibres provides generally a low cost construction and the elimination of the need for waste disposal in landfills.

The advantages of using coconut fibres are they are of low cost, low density, reasonable specific strength, good thermal insulation, reduce wear and availability to be recycled with minimal impact on environment.

1.3 FIBRE REINFORCED CONCRETE

Fibre reinforced concrete is defined as a composite material of cement concrete and uniformly dispersed fibre. Fibres are having some characteristic properties and its material can be of anything. But not all will be economical and effective. Some of the most commonly used fibres are:

1.3.1 Steel Fibre

Steel fibre reinforced concrete is a composite material that can be sprayed. SFRC is able to withstand light and heavy loads. The flexural strength of fibre reinforced concrete is greater than the unreinforced concrete. The SFRC by withstanding tensile cracking. It consists of hydraulic cements with steel fibres that are randomly orientated and possess a rectangular cross section. SFRC is isotopic in nature that improves the resistance to fracture and fatigue.

Figure 1: Steel fibre reinforced concrete

1.3.2 Glass Fibre

Glass fibre reinforced concrete is manufactured into big panels with a simple configuration or into a complex shape by using special technique. Several structure use glass fibre reinforced concrete for dissimilar facing like bricks, tiles and architectural purposes. Glass fibre reinforced concrete components were anchored directly with the building by the use of metal struts. Glass fibres are straight, diameter ranges from 0.005 to 0.015 mm.

1.3.3 Carbon Fibres

Carbon fibres have been used due to their very high modulus of elasticity and flexural strength. Characteristics such as strength and stiffness are better than those of steel fibres.

Figure 2: Glass fibre

Figure 3: Carbon fibre

1.3.4 Coconut Fibres

Coconut fiber is removed from the external shell of the coconut. There are two kinds of coconut fiber, first is darker fiber which is removed from the developed coconut and second is white fiber which is extricated from youthful coconuts. Dark colored filaments are thick, solid and have high scraped spot obstruction where as white strands which are smoother, better and more fragile. Coconut filaments are accessible in three sorts in length strands, moderately short strands and blended filaments. These kinds of filaments have diverse utilizations relying on their necessities. Dark colored strands are most generally utilized in building.

Figure 4: Coconut fibre

1.3.5 Synthetic Fibres

Nowadays synthetic fibres are mostly used in various field and some of the different types of synthetic fibres are- nylon fibre, polyester fibre and polypropylene fibre.

a. Nylon fibre

Nylon fibres are of hydrophilic nature. Nylon fibres bond are chemically to the concrete matrix because of their strong affinity to water and the bond of polypropylene and polyester fibres is only mechanical. They can be added in smaller dosage to produce same reinforcing effects.

b. Polyester

The fibre bundles come in monofilament form of ¾ to 2 inches in length. They have a tendency to disintegrate in the alkaline environment of Portland cement concrete. Manufactures of polyester fibres coat the fibres to resist alkali attack.

Figure 5: Nylon fibre

Figure 6.Polyester

c. Polypropylene

These fibres are hydrophobic, so they don't absorb water and have no effect on concrete mixing water requirements. They are widely used in ready mix concrete. They come as either fibrillated bundles or monofilaments. The fibre length ranges from ¼ to 21/2 inches. It is plain, twisted, fibrillated and ends with buttoned ends.

1.3.6 Natural Fibres

Natural fibres are classified into two types: plant fibres and animal fibres.

a. Plant Fibre

Plant fibres include seed hairs, such as cotton; stem or bast fibres, such as flex and hemp; leave fibres, such as sisal and husk fibres, such as coconut. Coconut fibre is of two types, first is brown fibre which is extracted from the matured coconut and second is white fibre which is extracted from immature coconuts.

Brown fibres are thick, strong and have high abrasion resistance where as white fibres which are smoother, finer and weaker. Coconut fibres are available in three types- long fibres, relatively short fibres and mixed fibres.

The cotton fibres grow on the seed of a variety of plant of the genus Gossypium. From the four cotton species cultivated for fibre, the most important are hirsutum. Sisal fibres are obtained from Mexico, the hardy plant grows well in a variety of hot climate including dry areas unsuitable for other crops. Pine needles have high potential as reinforcing materials in polymer matrices based composites.

b. Animal Fibre

Animal fibres include wool, hair, silk and secretions. Silk is produced by the silk worms. The fed on mulberry leaves, it produces liquid silk that hardened into filaments to form its cocoon. The larva is then killed and heat is used to soften the hardened filaments so they can be unwound. Sheep are shorn of their wool usually once a year.

The true cashmere is the Kashmir goat, it is a fine undercoat hair is collected by either combing or shearing during the spring season. After sorting and scouring, the fibres are then cleaned of coarse outer hairs.

1.4 OBJECTIVE

The aim of this project is to study the influence of the coconut fibres on properties of concrete.

The objectives of this works are:

1. To study the properties of compressive strength and tensile strength of the concrete reinforced with coconut fibres.
2. To study the influence of coconut fibres having different volume (0.5%, 0.75%, 1%, 1.5%).
3. To analyze the durability of coconut fibre in acidic environment.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

1. Topic: Experimental investigations on bond strength between coconut fibre and concrete.
   By: Mazid Ali, Xiaoyang Li and Nawawi Chouw

   Abstract

   Impact of fiber installation length, breadth, pretreatment conditions and solid blend structure proportions on the bond quality between single coconut fiber and cement is researched. Fiber distances across are estimated by a stereo magnifying instrument. The improved conditions are proposed for evaluating the fiber pliable pressure, flexible modulus and strength. Single fiber haul out test are completed to decide load-slippage bends with the assistance of an instron elastic machine having load cell. The outcomes demonstrate that filaments have the greatest security quality with solid when installation length is 30mm, strands are thick, treated with bubbling water and solid blend structure proportion is 1:3:3.

2. Topic: Use of coconut fibres as an enhancement of concrete.
   By: Yalley, P.P and Kwan, A.S.K

   Abstract

   This examination depicts exploratory investigations on the utilization of coconut fiber as improvement of cement. At the point when coconut fiber was added to plain concrete, the torsional quality expanded by upto about 25% just as the vitality engrossing limit, however there is an ideal weight division (0.5% by weight of bond) past which the torsional quality began to diminish once more. An expansion in fiber weight part gave a predictable increment in malleability upto the ideal substance (0.5%) with relating fiber perspective proportion of 125. By and large the examination has exhibited that expansion of coconut fiber to solid prompts improvement of elasticity and strength.

3. Topic: Effect of alkali treatment on microstructure and mechanical properties of coir Fibres, coir fibre reinforced-polymer composites and reinforced-cementetious Composites.

By: Libo Yan, Nawawi Chouw, Liang Huang, and Bohumil Kasal

Abstract

The effect of fibre treatment on microstructure and mechanical properties of coir fibre, coir fibre reinforced epoxy (CFRE) and coir fibre reinforced cementitious composites were investigated. Scanning electronic microscope studies were carried out to examine the microstructure of untreated and treated coir fibres, fibre/cement interfaces. The test result show that coir fibre had a much cleaner and rougher fibre surface after alkali treatment however the treatment also reduces the damping ratio of the coir fibre reinforced epoxy. The microstructure of coir fibre, CFRE and CFRZ were correlated with their mechanical properties.

4. Topic: Effectiveness of crack control at early age on the corrosion of steel bars in low modulus sisal and coconut fibre-reinforced mortar.

By: M.A.Sanjuan and R.D.Toledo Filho

Abstract

This paper involves the study of the free plastic shrinkage and cracking sensitivity at early drying of mortars reinforced with low modulus sisal and coconut fibres, and the evaluation of the effectiveness of crack control at early age on the corrosion of steel bars, which is sensitive to the presence of cracks. Mortars sample with reinforcing bars were submitted to early drying after casting, to developed cracks in the vicinity of the rebar's, and then held at 100% RH and room temperature under 40 days when they were exposed to a chloride solution to enhance a corrosion rate of the steel bars. The corrosion of the steel bars was monitored by electrochemical measurement and observation of crack development.

5. Topic: A new treatment for coconut fibres to improve the properties cement based composite-combined effect of natural latex/ pozzolanic materials.

   By: Everton Jose da Silva, Maria Lidiane Marques, Fermin Garcia Velasco, Celso Fornari Junior, Francisco Luzardo, Mauro Mitsuuchi Tashima.

   Abstract

   A mix of regular latex, water and pozzolanic materials were assessed by debasement test and quickened maturing through cycles of wetting and drying CFC tests. To acquire a material with improved exhibitions so as to diminish the measure of calcium hydroxide present on the fibre surface, four types of coconut strands were tried. The decide the mechanical properties acquired from every treatment, flexural test on CFC composites were performed. The outcomes demonstrate that the treatment did with the common latex polymer structure film joined with the pozzolan layer improve the execution and strength of CFC.

6. Topic: Strength and durability of coconut-fibre-reinforced concrete in aggressive environments.

   By: Mahyuddin Ramli, Wai Hoe Kwan, Noor Faisal Abas.

   Abstract

   The best approach to minimise the deleterious effects on this structure is to use high strength, high performance concrete. When a crack starts because of the expansion and shrinkage at splash zone and expensive products are formed because of sulphate attack and the cracks will grow and propagate uncontrollably. The aim of the experiment is to mitigate this limitation by incorporating short, discrete coconut fibre in a high strength concrete. The mineralogy and microstructure were studied by means of x-ray diffraction and scanning electron microscopy examinations. The result signifies that the fibres play a role in restraining the development of cracks. The deleterious effects brought about by aggressive environment can be suppressed with fibre reinforced concrete.

7. Topic: The behaviour of coconut fibre reinforced concrete (CFRC) under impact loading.

   By: Wenjie Wang, Nawawi Chouw.

   Abstract

   It represents the behaviour of coconut fibre reinforced concrete composites under drop weight impact loading. Both single and repeated impact tests were conducted suing a drop weight device. Various impact energy was applied to the specimens by adjusting the drop height. Both plain concrete and coconut fibre reinforced concrete cylinders with the identical size of 200mm x 100mm were tested. The relationship between the impact height and maximum impact stress was examined and an empirically derived equation was purposed.

8. Topic: Tensile behaviour of the coir fibre and the related composites after NaOH treatment.

   By: Huang Gu.

   Abstract

   Tensile strength of the alkali treated fibre was measured. The brown coir fibres were treated by NaOH solution with concentration from 2% to 10% separately. A decreased trend of the fibre tensile strength with increase NaOH density was found. In case of the NaOH density with 10%, lower tensile strength of the composite was noticed compare to the cases of 2%, 4%, 6% and 8%. No significant difference was revealed in the composite tensile strength among the cases of 2%, 4%, 6% and 8%. This implied that the improved adhesive ability of the coir fibre with the matrix after the alkali treatment had been outweighed by the strength loss of the fibre in these four cases.

9. Topic: Application of coconut fibres as outer eco-insulation to control solar heat radiation on horizontal concrete slab roof top.

   By: Danny Santoso Mintorogo, Wanda K Widigdo and Anik Juniwati.

   Abstract

   This paper deals with the use of coconut fibre to build thermal insulation on concrete slab roofing's and the experimental measurements of roof surface and indoor air temperatures derived from dynamic climatology of solar radiation. Monthly average temperatures on rooftop concrete slab and room air temperatures were conducted. Coconut fibres will be considered as natural sustainable insulator with the following aspects: practising to respect natural materials within the built environmental, promoting less hazardous roofing insulation of the material used, limiting the impacts on the urban built atmosphere and preserving the cooling energy demand by mitigation the flat concrete rooftop thermal onto the room, the energy consumption reduction is around 3% and 9%.

10. Topic: Development of coconut coir-based lightweight cement board.

    By: C. Asasutjarit, J. Hirunlabh, J. Khedari, S. Charoenvai, B. Zeghmati, U. Cheul Shin

    Abstract

    The investigation focused on parameters, mainly, fibre length, coir pre treatment and mixture ratio that affect the properties of boards. They are intended to be used as building components for energy conservation. Results of this studies indicated that the best pre treatment of coir fibre was to boil and wash them as it can enhance some of the mechanical properties of coir fibre. The optimum fibre length was 1-6cm fraction, and optimum (cement: fibre: water) mixture ratio by weight was 2:1:2. The investigation on thermal property of specimen revealed that coconut coir based lightweight cement board has lower thermal conductivity than commercial flake board composite.

CHAPTER 3
STUDY ON MATERIALS USED

3.1 GENERAL

Concrete is a site made material unlike other materials that can vary to great extend in terms of performance, its properties and quality. Concrete is a freshly mixed material which can be moulded in any shape. Properties of material are important to make concrete durable and workable.

Material used in this projects are- Cement (PPC), coarse aggregates (aggregates passing through 20mm sieve and retained on 4.75mm sieve), fine aggregates (Zone II sand), Coconut fibre, water(portable water).

3.2 CEMENT

Portland-pozzolana cement.can.be.produced.either by grinding.together.Portland bonds clinker and pozzolana with an expansion of gypsum.or.calcium sulphate, or by intimately.and consistently mixing Portland concrete with fine pozzolana.Portland-pozzolana concrete delivers less warmth of hydration and offers more noteworthy protection from the assault of forceful waters than typical Portland bond; it decreases the draining of calcium hydroxide freed amid the setting and hydration of bond. The pozzolanic materials by and large utilized for production of PPC are calcined earth or fly fiery debris.

Portland concretes are arranged into five kinds and mixed bonds are grouped into sort I-P, type I-S, where type I is universally useful concrete which is reasonable for the utilizations when the extraordinary properties of different sorts not required. Type II is utilized when fixation higher in sulphur ground water than ordinary, likewise it limited temperature rise. This kind of bond is utilized for structure like overwhelming holding divider, extensive wharfs and so forth.

Type III cement is high early strength cement which will develop higher strength at an earlier stage whereas Type IV and Type V are used in massive structures such as dam and used in concrete exposed to severe sulphate action respectively. Type I-P blended cement is a combination of Portland cement and pozzolan but when combined with moisture and calcium hydroxide it produces cementing effect whereas Type I-S blended cement is a combination of Portland cement and blast furnace slag.

3.3 COARSE AGGREGATE

Coarse aggregates are defined as uncrushed gravel or stone which results from natural disintegration of rock or can be defined as crushed gravel or stone when it results from crushing of gravel or hard stone and partially crushed gravel or stone when it is the product of the blending of uncrushed gravel stone and crushed gravel or stone. For the coarse aggregate IS 383:1970 code is used.

3.4 FINE AGGREGATE

Aggregates are the most important material in concrete which is used to reduce shrinkage and effect economy. Aggregate consists of naturally occurring stones, gravel and sand or the combination of all. They should be hard, strong, durable, clean and free from coating, alkali, vegetable matter and other deleterious substances.

Fine aggregate can be defined as the aggregate most of which passes through 4.75mm sieve and retained on 150 micron IS sieve. Fine aggregates can be natural sand which is resulting from the natural disintegration of rock, crushed stone sand produced by crushing hard stone, crushed gravel sand produced by crushing natural gravel. IS 383:1970 is used for the fine aggregates.

Figure 7. Aggregates

3.5 WATER

Portable water is generally considered for mixing concrete and the pH value of water should not be less than six. According to IS 456:2000, water used for mixing and curing should be free and clean from oils, acids, alkalis, salt, sugar, organic materials and other substances that are deleterious to concrete.

CHAPTER 4

EXPERIMENTAL WORK

4.1 OBJECT OF TESTING

4.1.1 TEST ON CEMENT

To check the various properties of cement, different tests were done. The tests done are:

4.1.1.1 Standard Consistency

It is defined as that consistency which will permit the Vicat plunger of 10mm diameter and 50 mm length to penetrate to a point 5 to 7mm from the bottom of Vicat mould.

Figure 8. Standard Consistency Apparatus

4.1.1.2 Initial Setting Time

Initial setting time is regarded as the time elapsed between the moment that the water is added to the cement to the time that the paste starts losing its plasticity.

4.1.1.3 Final Setting Time

It is the time elapsed between the moments that the water is added to the cement and when the paste has completely lost its plasticity.

Figure 9: Needles for Initial setting time and Final setting time for cement.

4.1.2 TESTS ON AGGREGATE

4.1.2.1 Fine Aggregate

Particle size distribution in a sample of an aggregate is done by sieve analysis. The standard sieves for sieve analysis of fine aggregates are 4.75mm, 2.36mm, 1.18mm, 600μ, 300μ, 150μ and the gradation curve.

INFERENCE

As per IS 383:1970, the fineness of fine aggregate is lying in Zone II.

4.1.2.2 Coarse Aggregate

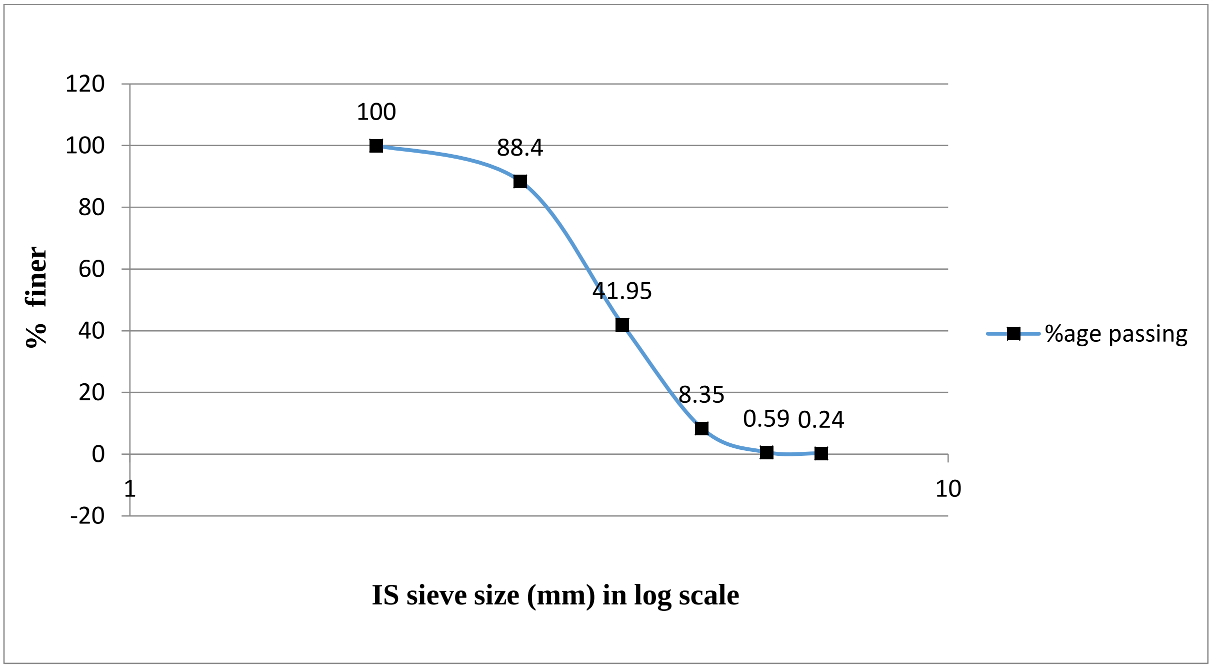
The aggregates occupied 70% to 80% of the volume of concrete; their impact on various characteristics and properties of concrete is considerable. Therefore various tests were performed for coarse aggregate.

Particle size distribution in a sample of an aggregate is done by sieve analysis. In this sample of aggregate is divided into various fraction, each consisting of particle of same size and the gradation curve was plotted. Specific gravity of an aggregate is considered to be measure of strength or quality of the material. Aggregates having low specific gravity are weaker than those with higher specific gravity values.

Figure 10. Sieve analysis of coarse aggregate

Table 1: Sieve analysis of coarse aggregate

IS sieve (mm)	Wt. retained on each sieve (gm)					Percentage retained on each sieve	Cumulative % on each sieve	% finer
	1	**2**	**3**	**4**	**Average**			
20	0	0	0	0	0	0	0	100
16	143	159	167	227	174	11.6	11.6	88.4
12.5	716	686	726	659	696.75	46.45	58.05	41.95
10	526	531	464	495	504	33.6	91.65	8.35
4.75	94	117	141	114	116.5	7.76	99.41	0.59
Pan	8	7	1	5	5.25	0.35	99.76	0.24



Graph 1: Gradation curve for coarse aggregate.

INFERENCE

As per IS 383: 1970, the fineness of coarse aggregate is lying in Zone II, water adsorption for coarse aggregate was 2.3% and as per IS 2386-Part III: 1963, the average value of specific gravity should lies between 2.6-2.8.

4.2 M30 MIX DESIGN CONCRETE

$F'_{ck} = F_{ck} + 1.65s$

F'_{ck} = Target average compressive strength at 28 days

F_{ck} = Characteristics compressive strength at 28 days

s = Standard deviation (From Table 1, IS: 10262)

For M-30 grade, s = 5 N/mm^2

Target strength = 30+1.65×5

= 38.25 N/mm^2

Table 2. Mix Design

Fck	**Ft**	**w/c**	**Cement content (kg)**	**Water content**	**Volume of aggregate (m^3)**	**Fine aggregate weight (kg)**	**Coarse aggregate weight (kg)**	**Zone of aggregates**
30	38.25	0.40	400	180	0.714	662.24	1212.94	II

Cement	:	Sand	:	Coarse aggregate	:	Water
400	:	662.24	:	1212.94	:	160
1	**:**	**1.6**	**:**	**3.03**	**:**	**0.4**

4.3 CASTING AND CURING

Determined measure of concrete and fine total are combined until a uniform blend is gotten. Strands at different measures of 0.5%, 0.75% and 1% to that of volume of concrete are taken.

Coarse total are then added to a similar blend with the option of water. Care ought to be taken to include water gradually in stages in order to anticipate draining which may influence the quality arrangement of cement. It is set in the moulds of standard measurement (150mm x 150mm x 150mm), compacted and wrapped up. The remoulded examples in the wake of being restored for adequate timeframe are then taken out and dried and tried under standard testing contraption. The few phases have been done as pursues for the throwing and restoring.

1 After the procurement of materials, the mixing is done in a concrete mixer for the mix design of M30 grade.

Figure 11: Concrete Mixer

2 After mixing the materials, it is then filled in moulds of 150mm x150mm x150mm and compacted using table vibrator and let it dry for 24hours.

Figure 12: Casting Of Cube in Moulds

3 On next day of casting, samples were demoulded.

Figure 13: Demoulded cubes

4 Samples were cured in the curing tank for 7 and 28 days.

Figure 14: Curing tank

Figure 15: Sample dried for testing

5 Testing of samples were done with the help of Universal Testing Machine(UTM) and Compression Testing Machine.

Figure 16: Compression Testing Machine

Figure 17: Universal Testing Machine

6 Cracked pattern of the sample

Figure 18: Cracked pattern

CHAPTER 5

RESULTS AND CONCLUSION

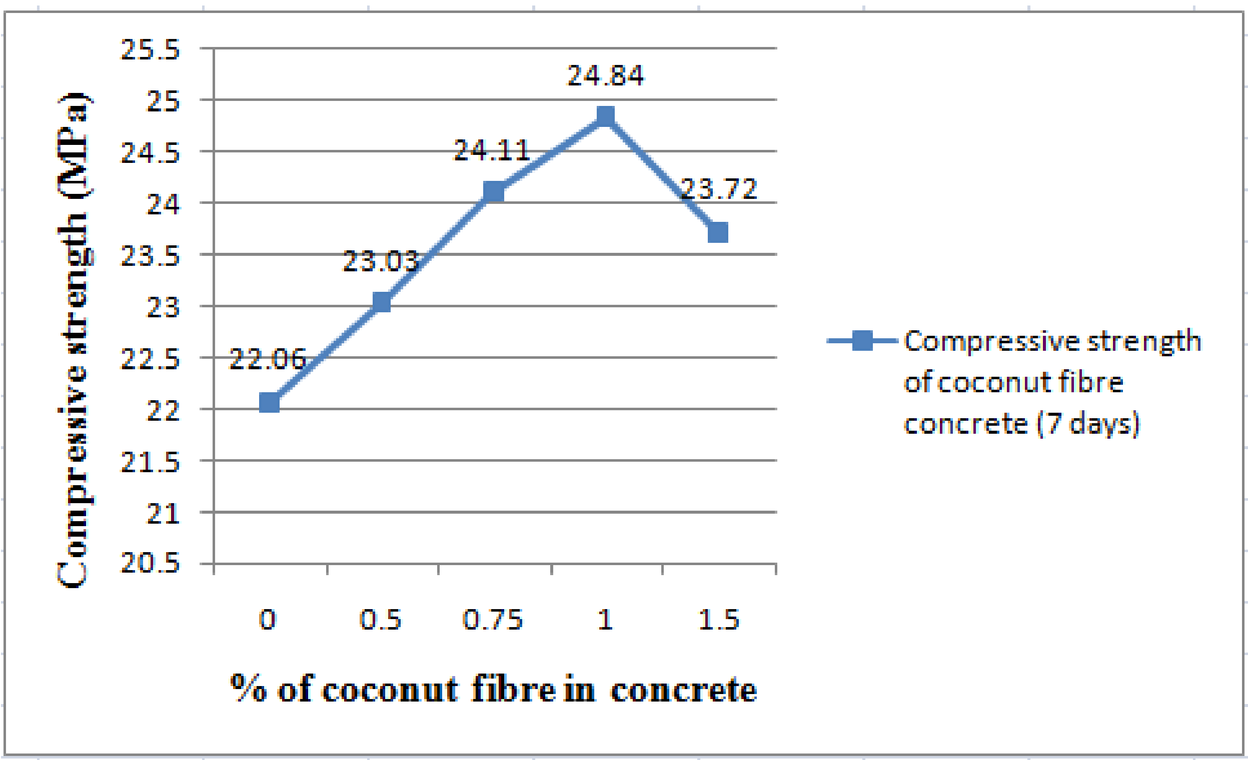
5.1 Compressive Strength Observations and Result

Table 3: Compressive test after 7 days

Compressive Test On Cube (7days)				
	Sample No.	Load in(KN)	Strength in (MPa)	Average
M30 Concrete	1	472.50	21.00	22.06
	2	506.25	22.50	
	3	510.75	22.70	
Coconut fibre (0.5%)	1	517.72	23.01	23.03
	2	520.20	23.12	
	3	517.05	22.98	
Coconut fibre (0.75%)	1	543.15	24.14	24.11
	2	541.80	24.08	
	3	542.70	24.12	
Coconut fibre (1%)	1	550.57	24.47	24.84
	2	551.47	24.51	
	3	552.15	24.54	
Coconut fibre (1.5%)	1	533.47	23.71	23.72
	2	534.15	23.74	

Compressive strength of coconut fibre (7days)	
% of coconut fibre	Strength (MPa)
0%	22.06
0.5%	23.03
0.75%	24.11
1%	24.84
1.5%	23.72

Table 4: Compressive strength of coconut fibre concrete (7days)



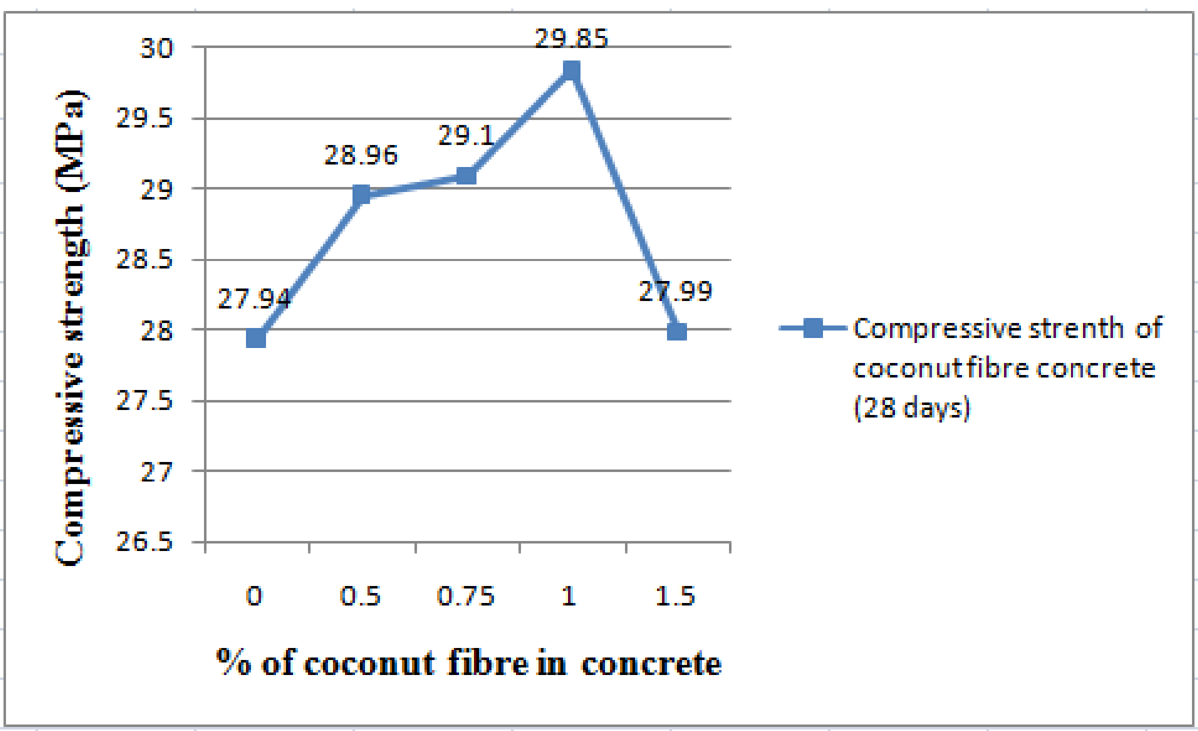
Graph 2: Compressive strength of coconut fibre concrete (7days)

Table 5: Compressive test after 28 days

Compressive Test On Cube (28days)				
	Sample No.	Load in(KN)	Strength in (MPa)	Average
M30 Concrete	1	634.50	28.20	27.94
	2	612.00	27.70	
	3	628.42	27.93	
Coconut fibre (0.5%)	1	650.92	28.93	28.96
	2	651.37	28.95	
	3	652.72	29.01	
Coconut fibre (0.75%)	1	655.42	29.13	29.10
	2	654.30	29.08	
	3	654.75	29.10	
Coconut fibre (1%)	1	671.85	29.86	29.85
	2	672.52	29.89	
	3	670.72	29.81	
Coconut fibre (1.5%)	1	629.32	27.97	27.99
	2	630.22	28.01	

Compressive strength of coconut fibre (28days)	
% of coconut fibre	Strength (MPa)
0%	27.94
0.5%	28.96
0.75%	29.10
1%	29.85
1.5%	27.99

Table 6: Compressive strength of coconut fibre concrete (28days)



Graph 3: Compressive strength of coconut fibre concrete (28days)

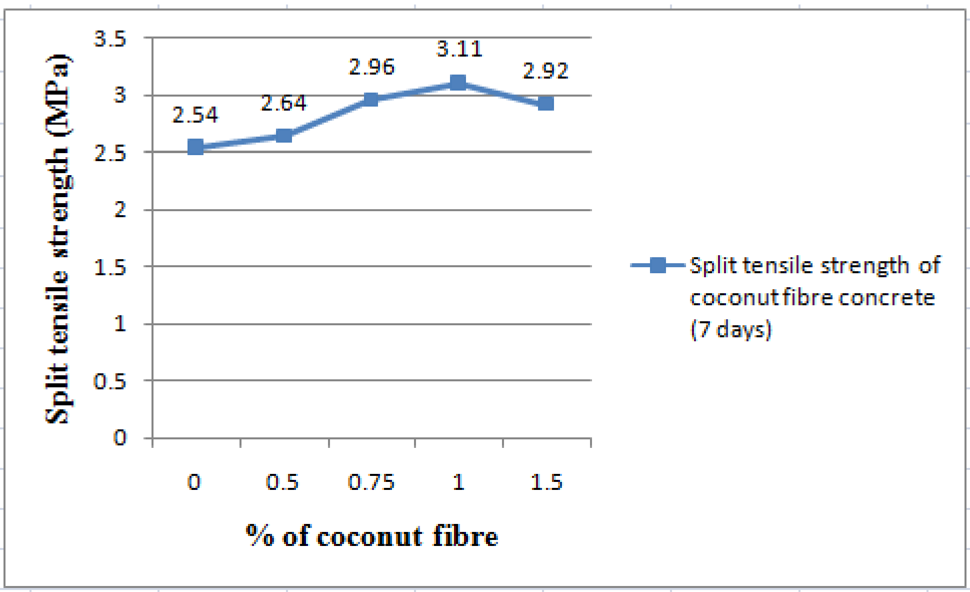
5.2 Split Tensile Strength Observations and Result

Table 7: Split tensile test after 7 days

Split Tensile Test (7days)				
	Sample No.	Load in(KN)	Strength in (MPa)	Average
M30 Concrete	1	79.48	2.53	2.54
	2	80.11	2.55	
Coconut fibre (0.5%)	1	82.30	2.62	2.64
	2	83.88	2.67	
Coconut fibre (0.75%)	1	90.47	2.88	2.96
	2	95.50	3.04	
Coconut fibre (1%)	1	97.07	3.09	3.11
	2	98.33	3.13	
Coconut fibre (1.5%)	1	92.04	2.93	2.92
	2	91.42	2.91	

Table 8: Split tensile strength of coconut fibre concrete (7days)

Split Tensile strength of coconut fibre (7days)	
% of coconut fibre	Strength (MPa)
0%	2.54
0.5%	2.64
0.75%	2.96
1%	3.11
1.5%	2.92



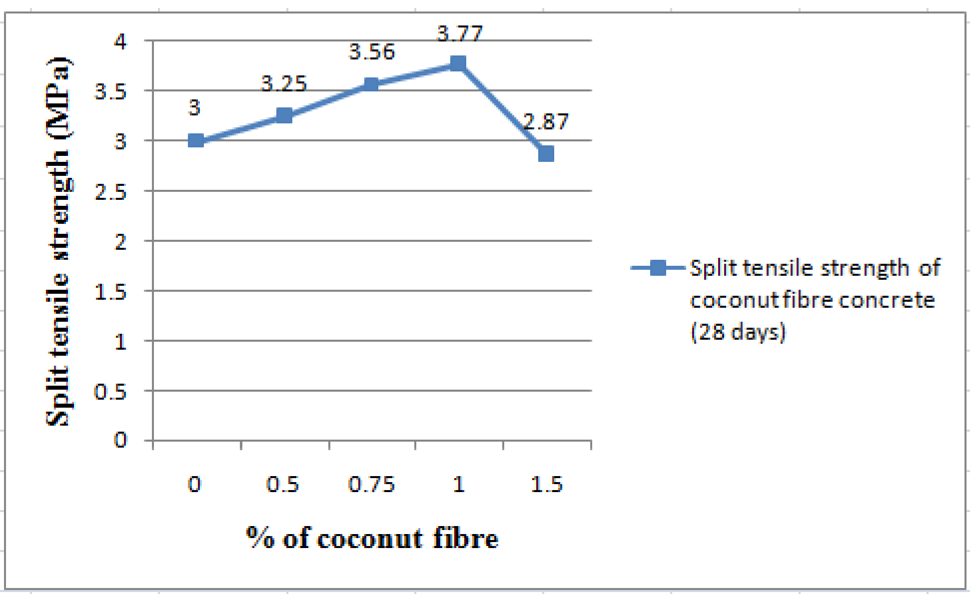
Graph 4: Split tensile strength of coconut fibre concrete (7 days)

Table 9: Split tensile test after 28 days

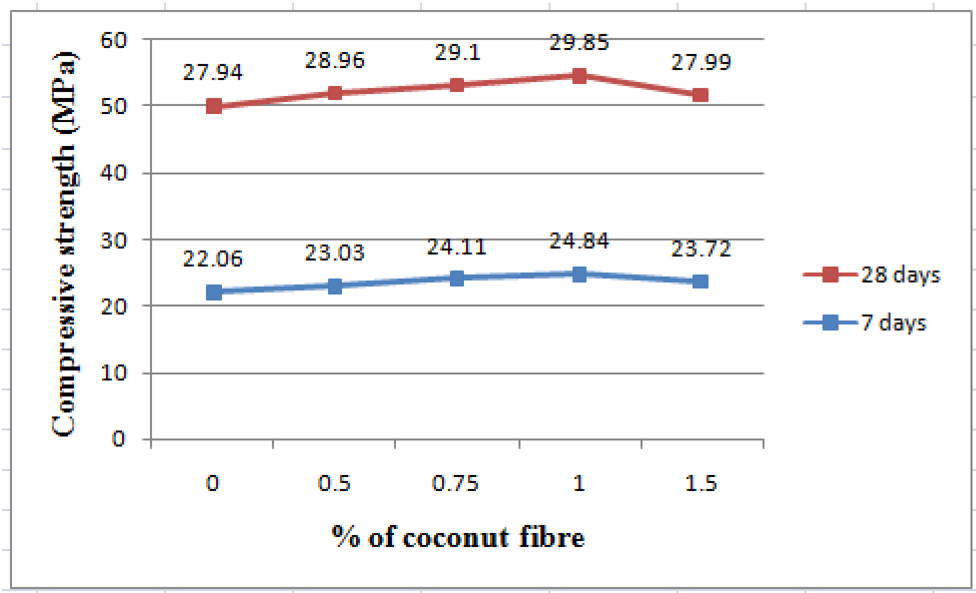
Split Tensile Test (28 days)				
	Sample No.	Load in(KN)	Strength in (MPa)	Average
M30 Concrete	1	94.56	3.01	3.00
	2	93.93	2.99	
Coconut fibre (0.5%)	1	101.78	3.24	3.25
	2	102.73	3.27	
Coconut fibre (0.75%)	1	111.21	3.54	3.56
	2	112.46	3.58	
Coconut fibre (1%)	1	119.06	3.79	3.77
	2	117.80	3.75	
Coconut fibre (1.5%)	1	89.84	2.86	2.87
	2	90.47	2.88	

Table 10: Split tensile strength of coconut fibre concrete (28 days)

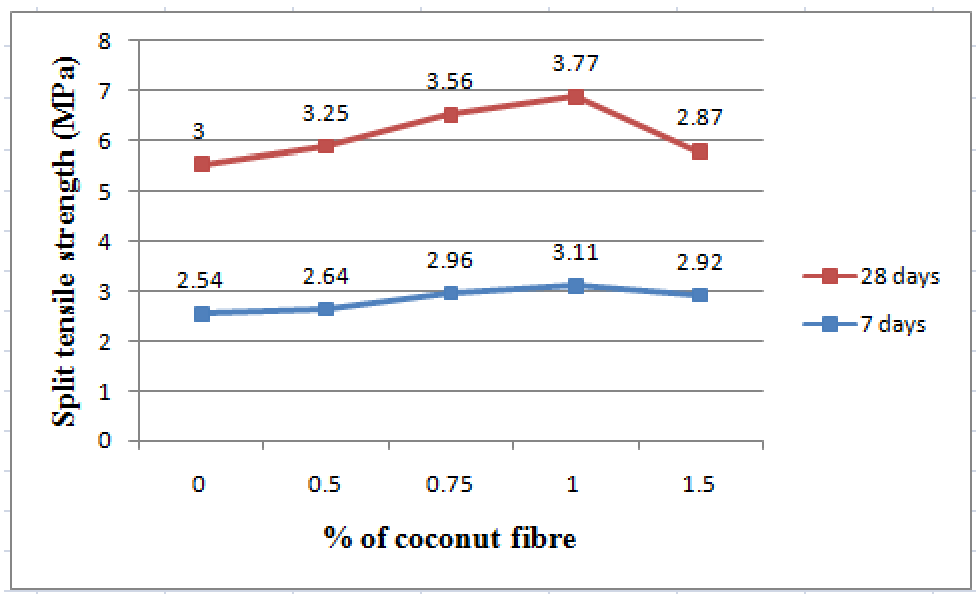
Split Tensile strength of coconut fibre (28 days)	
% of coconut fibre	Strength (MPa)
0%	3.00
0.5%	3.25
0.75%	3.56
1%	3.77
1.5%	2.87



Graph 5: Split tensile strength of coconut fibre concrete (28 days)



Graph 6: Graph between 7 days and 28 days compressive strength



Graph 7: Graph between 7 days and 28 days split tensile strength

5.3 Workability

Table 11: Workability for the different fraction of coconut fibre

Percentage of coconut fibre	Observation (cm)
0.5	29.8
0.75	29.2
1	28.7
1.5	-

Figure 19: Workability using slump cone test.

5.4 CONCLUSION

5.4.1 Compressive Strength

- The compressive strength of M30 concrete with the addition of 0.5%, 0.75%, 1% coconut fibre at the end of 7 and 28 days was observed to be 23.03 and 28.96 MPa for 0.5%, 24.11 and 29.10 MPa for 0.75% & 24.84 and 29.85 MPa for 1%. Due to temperature fluctuation, the rate of hydration was low so, the targeted compressive strength for M30 concrete was not achieved.
- The compressive strength of normal M30 concrete for the duration of 28 days comes out to be 27.94 MPa.
- On addition of 1.5% of coconut fibre of total weight of concrete, the compressive strength decreased and comes out to be 27.99 MPa after 28 days because the high fibre content composites can have reduced compressive strength.
- From literature, we know volume fraction up to about 1% does not crucially effect compressive strength because strength reduction is mainly due to increased amount of entrapped air due to presence of fibres.

5.4.2 Split Tensile Strength

- The split tensile strength of M30 concrete with the addition of 0.5%, 0.75%, 1% coconut fibre at the end of 7 and 28 days was observed to be 2.64 and 3.25 MPa for 0.5%, 2.96 and 3.56 MPa for 0.75% & 3.11 and 3.77 MPa for 1%. Due to temperature fluctuation, the rate of hydration was low so, the targeted compressive strength for M30 concrete was not achieved.
- On addition of 1.5% of coconut fibre of total weight of concrete, the split tensile strength decreased and comes out to be 2.87 MPa after 28 days because the high fibre content composites can have reduced split tensile strength.
- The tensile strength of coconut fibre ranges from 15MPa to 220MPa.
- On addition of 1% of coconut fibre of total weight of concrete the split tensile strength increased to 3.77MPa.

5.4.3 Workability

- It has been observed that with increasing of coconut fibre percent, it decreases the workability and if we increase the water cement ratio to improve the workability then it reduces the strength of concrete.
- With the addition of 0.5%, 0.75%, 1% of coconut fibre, the workability reduces from 29.8cm, 29.2cm, and 28.7cm respectively and with the addition of 1.5%, the shape was distorted.

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