# THE EFFICIENCY OF USING COCONUT FIBER TO GET LIGHTWEIGHT CONCRETE

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A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering


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Section: CE0122-Bismuth_Thesis (15D)

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# DECLARATION

It is hereby declared that this thesis/project or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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***Dedicated***

*to*

*"*Our Beloved Teacher's*"*

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We would like to express our special thanks of gratitude to our teacher as well as our principal who gave us the golden opportunity to do this wonderful project on the topic "The Efficiency of Using Coconut Fiber to Get Lightweight Concrete" which also helped me in doing a lot of Research and we are came to know about so many new things. We are really thankful to them.

# ABSTRACT

Due to urbanization, the amount of construction work is constantly increasing. Concrete is the most essential element in this construction work. A large number of natural materials are being used in making this concrete. The main components of concrete making, such as sand, cement and Brick or stone chips are directly and indirectly natural components. The possibility of increasing its use, raise the harmful effects on the environment day by day. That's why should be use natural ingredients as an alternative. Considering that aspect, Coconut fiber is a lightweight and less costly. an exploration conducted that, Replaced Coconut fiber in concrete with coarse aggregate by several cylinder specimen. the volume of coconut fiber taken 5%, 10% & 15% instant of the coarse aggregate in concrete sample, also taken a Plain concrete specimen. The cylinders are 4 " diameter and 8" height specimen are tested the compressive strength, tensile strength and weighed them. As a result of the test carried out that, the maximum tensile strength of plain concrete i.e., without coconut fiber was 1.881Mpa & Compressive Strength 24.176Mpa. The highest coconut fiber concrete (i.e., 15% coconut fiber replaced) tensile Strength was 1.773Mpa and Compressive Strength 23.436Mpa. Here optimum coconut fibers were 5% replace with coarse Aggregate the maximum tensile of concrete 1.804Mpa and Compressive Strength 24.052Mpa. Through the research, found that mixing a certain amount of coconut fiber as an alternative by coarse aggregate in concrete mix, although the strength of concrete is a bit less, but it can be used for construction work.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background and Motivations

In the modern globalization, the worldwide have lot of interest in the using of natural materials in all the installations in cement composites. Almost all over the world, Natural fibers are produced in large quantities in a natural way and have become a focal point of human interest for its availability. Various types of fibers were used in concrete to it make more strong, economical Durable. Here talking about the fibers, and fruits fibers etc. Coconut fiber is an alternate natural ingredient, because Coconut fibers are easily available in huge quantity and also cost is very low.

Lots of natural materials are using to create new buildings or different type's projects that are constantly being built around the world. To get a lot of these natural resources to extract sand stones and other materials from the river and sea the amount of this extraction is increasing day by day. In the days to come, these natural ingredients will be much harder to find and the cost will increase in part. In addition, there is a possibility of a major environmental catastrophe for these collecting natural materials.

From different research, try to get know effect of using coconut fiber in concrete. And get lots of information from the research. The Fiber reinforced concrete has more tensile strength when they compared with non-reinforced concrete. This coconut fiber increases the concrete's durability. It decreases split development and increments impact strength. Somewhere found some results where they used coconut fiber; they used it in different way and get some positive results and feedback.

- In different country base, they use a percentage of coconut fiber as a coarse aggregate in concrete.
- They used coconut fiber in another way, as a fine aggregate in concrete.
- Also, they used this coconut fiber replace with cement.

We are motivated from different research and trying to get positive feedback. If we get a great result from this research and if it will be low cost with economical, then hope we can use it from the future project. So that's why we make this decision to work with this coconut fiber using in concrete.

## 1.2 Research Objectives and Overview

1. To find the value of compressive Strength and tensile strength of concrete containing natural aggregate and coconut fiber as a partial replacement.
2. To compare the compressive strength and tensile strength of concrete containing natural aggregate and coconut fiber.
3. To find optimum value and to get to know how much Parentage can be replaced instead of natural aggregate.

## 1.3 Organization of the thesis

This Thesis comprises of five chapters organized as follows:

**Chapter 1: Introduction and Objective:**

This chapter given the background about significance of the research, motivation and reach to desired objectives.

**Chapter 2: Literature Review:**

This chapter given a general review of previous experiment related to know about fiber reinforced concrete and Properties of the concrete with their Pros and cons.

**Chapter 3: Methodology:**

This chapter described the materials used in this research, with their mixing ratio, testing Specimen and equipment was used in the testing properties.

**Chapter 4: Results and Discussion.**

This chapter describes the results of various types test on the fiber reinforced concrete That perform in the whole thesis.

**Chapter 5: Conclusions and Future Work.**

This chapter discusses the conclusion of the whole research and whether there is any Scope to work on it in future.

# CHAPTER 2
# LITERATURE REVIEW

## 2.1 Introduction

A Research carrier out by Abhijeet.R.Agrawal with his team (January 2014) From India [14], They use coconut fiber in mixture 5% by weight of cement in concrete. The coconut fibers with diameter around 0.29mm and 0.83mm and length between 6mm and 24mm.To take the compressive and tensile strength test. The optimum tensile strength was gotten 3.0 MPa. The compressive strength of concrete increases with curing age but decrease with increase in quantity of coconut fiber, whereas its tensile strength increases.

They are Conducted Compressive Strength and Tensile strength test for understanding the Strength & lightweight behavior of the coconut fibers. Abhijeet.R.Agrawal from India studied strength & lightweight of coconut fiber concrete Properties.

Their aim was low-cost natural materials using at a time with light self-weight. Their study focused on coconut fiber as good and hazardous less construction materials.

The investigation by Waqas Ahmed with his team (February 2020), [15], The test comes about uncovered that CFR-HSC has improved compressive, splitting-tensile, flexural qualities and vitality retention and durability indices compared to HSC. The influence of 25 mm-, 50 mm-, and 75 mm-long coconut fibers and 0.5%, 1%, 1.5%, and 2% substance by mass is examined. The concluded in this research results best comes about are gotten for the CFR-HSC having 50 mm long coconut fibers with 1.5% substance by cement mass.

We are motivated for an Experiment about Coconut fiber Concrete. Here uses coconut fiber instead of coarse Aggregate in different percentage such as 5%, 10% & 15% on the volume. Here can be compare other investigation on act concrete with coconut fiber. Compressive strength & Tensile Strength apply in the Concrete specimen, to know difference between previous experiment and our experiment.

## 2.2 Content

The description of the materials content that used in previous researches are given below.

### 2.2.1 Concrete

Concrete could be a composite material composed of fine and coarse aggregate reinforced beside a liquid cement (cement paste) that solidifies (cures) over time. Concrete is the second-most-used substance within the world after water [1], and is the foremost broadly utilized building material [2].

When the total is mixed with dry Portland cement and water, the blend shapes a liquid slurry that's effectively poured and molded into shape. The cement responds with the water through a preparation called concrete hydration that solidifies over several hours to create a difficult framework that ties the materials together into a solid stone-like material that has numerous employments [20].

### 2.2.2 Cement

Cement may be a cementing or binding material utilized in building development. It is basically utilized in concrete work. It is fabricated from the calcareous substance (compounds of calcium and magnesium) and is similar in numerous regards to the emphatically hydraulic limes but has distant more noteworthy hydraulic properties. [13] Cement mixed with fine aggregate produces mortar for masonry or sand and rock which produces concrete. Concrete is the foremost broadly utilized material in the presence and is behind as where water is the planet's most-consumed asset.

### 2.2.3 Volume of fibers

The Quality of the composite for the foremost portion depends on the sum of fibers utilized in it. [16] It can be seen that the increase within the volume of fibers, increment approximately nearly, the ductile quality and sturdiness the composite. Higher rate of fiber is likely to cause isolation of concrete mortar.

### 2.2.4 Fine Aggregate

Sand is routinely utilized as fine aggregate in Bangladesh. Stone screenings, devoured muds, sediment, and fly-ash are here and there utilized as a substitute for sand in making concrete. [17] The fine aggregate should not to be greater than 3/16 inch (4.76mm) in width.

### 2.2.5 Coarse Aggregate

Khoa (broken pieces), broken stones, rock, stones, clinker, sediment and so on of the degree of 3/16 to 2 inches are regularly utilized as a coarse Aggregate in Bangladesh. [3] It may well be reviewed that 3/16 inch is the apportioning lime among fine and coarse aggregates.

## 2.3 Concrete Properties

Properties of concrete are impacted by numerous variables primarily due to the blend extent of cement, sand, aggregates, and water. The proportion of these materials controls the different concrete properties which are examined underneath.

### 2.3.1 Durability of concrete

Durability shows the life period of the material beneath the given natural conditions. In common, concrete is durable beneath ordinary natural circumstances. The durability issues arise due to either unconsciously presenting harmful materials while including the constituents or when the concrete is uncovered to serious destructive natural conditions not anticipated prior. External moisture or air can enter through the concrete which can encourage the erosion of steel embedded in the concrete in the case of reinforced cement concrete. This erosion movement may lead to an increment in the volume of steel which in turn starts splitting and spalling of concrete cover. [18]

Durability is characterized as the capability of concrete to stand up to weathering activity, chemical assault and abrasion whereas keeping up its wanted designing properties. It ordinarily alludes to the length or life span of inconvenience- free execution. Diverse concretes require diverse degrees of durability depending on the introduction environment and properties craved [19]. For illustration, concrete uncovered to tidal seawater will have diverse necessities than indoor concrete.

### 2.3.2 Effect of fiber substance in Cement sand mortar

To explored mechanical properties of coir Fiber reinforced cement sand mortar. The researcher tested two distinctive plan blends (cement sand proportion by weight), to begin with was 1:2.75 with water cement proportion of 0.54 and moment was 1:4 with water cement proportion of 0.82. Fiber substance was 0.08, 0.16 and 0.32 % by add up to weight of cement, sand and water. The mortars for both design mixes without any strands were moreover tried as reference. Cylinders having estimate of 50 mm breadth and 100 mm height and bars having estimate of 50 mm width, 50 mm depth and 200 mm length were tried for compressive and flexural quality. The curing was done for 8 days only. It was found that all qualities were expanded in case of fiber fortified mortar as compared to that of plain mortar for both blend plan with all fiber contents. However, a diminish in quality of mortar was also observed with an increment in fiber substance. [7]

### 2.3.3 Workability of concrete

Consolidation of Coconut fiber diminishes the workability considerably. This circumstance antagonistically influences the consolidation of new blend. Now and then delayed external vibration comes up short to compact the concrete. The fiber volume at which this circumstance is come to depends on the length and diameter of the fiber. The workability and compaction standard of the blend is improved through expanded water/ cement proportion or by the use of a few kinds of water lessening admixtures. [21]

### 2.3.4 Mixing

Blending of fiber Reinforced concrete needs cautious conditions to dodge balling of filaments, isolation and in common the difficulty of blending the materials consistently. It is important that the strands are scattered consistently all through the mix; this can be done by the expansion of the filaments some time recently the water is included. When combining amid a research facility mixer, introducing the strands through a wire work wicker container will help even dispersion of strands. For field utilize, a few other suitable methods ought to be received. [21]

### 2.3.4 Cement Paste

The mechanical properties of cement paste composites for distinctive lengths and volume divisions of coconut fibers. The Tensile strength and modulus of rupture of cement paste expanded up to a certain length and volume division; that increment in length or the quality of composite the tensile strength and modulus of rupture of volume division diminished cement paste composite strengthened with diverse volume divisions of 38 mm long coconut fibers extending from 2 to 6 %. It can be effectively watched that 4 % volume division of coconut fibers had given the most elevated mechanical properties among all tried volume divisions. With 4% volume division, the creators too considered the tensile quality of cement glue strengthened with different lengths of coconut strands. The detailed ductile strengths were 2.3, 2.8 and 2.7 MPa with lengths of 25, 38 and 50 mm, separately. In this way coconut strands with a length of 38 mm and a volume division of 4% gave greatest strength of cement paste composite. [4]

### 2.3.5 Compressive Strength

Coconut fiber reinforced concrete was included to concrete at changing extents (1%, 2%, 3%, 4%, and 5%, of that of weight of cement) at a water cement proportion of 0.5. The specified slump value and compressive quality was gotten for customary concrete at this proportion. The Percentage of Coir Strength in 0% After 7 Days 13.65 & Strength After 28 Days 22.73, Similarly in 5% coir strength 15.02 & 26.20 (N/mm^2). [21]

### 2.3.6 Tensile Strength

The tensile strength tests were conducted on standard cylinders of measurement 15cm breadth and 30cm depth coconut fiber reinforced concrete was cast at shifting rates of fiber (1%, 2%, 3%, 4%, and 5%) For each case 28day quality values were gotten by loading beneath a compression testing machine. Three tests of PCC are checked amid the test, the average of their strength was 3.44. After expansion of different % of coir, The Percentage of Coir Strength in 1% After 28 Days 2.88 & 5% of coir 4.57. The average value 3.54. [21]

### 2.3.6 Advantage of coconut fiber concrete

Fiber mixed concrete has more strength when compared to ordinary concrete. It increases the concrete's workability. It decreases split development and increments impact strength. [11] Reinforcing concrete with fiber increases fatigue strength. [18]

### 2.3.7 Disadvantage of coconut fiber concrete

Rain might expose the fibers. Fibers randomly orient in the concrete and could result in poor quality concrete, if not uniform. [11] The concrete strength is reduced by growing percentage of fiber volume. [18]

## 2.4 Previous Study

Flowing research are getting from Researchers:

Scrap tires and polyolefin properties of concrete composites had been decided by Zengh [4] and Yan [5] individually. Zengh conclude that smashed rubberized concrete and damping proportion pounded will reach as tall as 144% and 75% separately with regard to PC. With increment in damping diminishes in reaction frequencies for examined FRC composite was established by Yan.

Another test conducted by Baruah and Talukdar [8], the diverse fibers volume extending from 0.5% to 2%, was performed a test to explore the inactive properties of plain concrete and fiber strengthened concrete. They utilize coir strands. They conclude that CFRC with 2% fiber appears superior results than all Volume divisions. There's an increment in 13.7%, 22.9%, 28.0%, 32.7% in quality, part tensile quality, modulus of rupture utilizing four-point uproarious test, and Shear strength individually as compared to PC.

The examination by Reis [6] characterizes the mechanical properties of epoxy polymer concrete reinforced with common fiber (Coconut, Sugarcane bagasse, banana fiber). Which conclude that fracture toughness and break vitality of coconut fiber strengthened polymer concrete where higher than that of other reinforced polymer concrete and there's 25% increment in flexural quality with coconut strands as it were.

After a try conducted by Gunasekaran and Kumar [9] they found that there's 24% tall water retention by concrete strengthened with coconut fiber compare to PC. They found that compressive quality of concrete increments with 19.1% than PC after curing 3d shape for 28 days.

Inquired about carrier out by Adeyemi, [10] for one blend proportion (1:2:4) utilizing reasonable coconut fiber for either fine or coarse total in concrete generation. They conclude that the weight of that concrete is light with compare to PC.

## 2.5 Summary

The information here linked based on the benefits of fiber reinforcement and the research of various researchers. Moreover, descriptions of different chapters of the entire research have been attached.

# CHAPTER-3

# METHODOLOGY

## 3.1 Introduction

For making coconut fiber concrete, collect materials and conduct various types of test (i.e. sieve analysis, specific gravity) then mixed 5%, 10%, 15% coconut fiber with plain concrete instead of course aggregate and make concrete cylinder specimen. To compare the strength and durability of the coconut fiber concrete with ordinary concrete specimen, to know how suitable this type of coconut fiber concrete using in construction work.

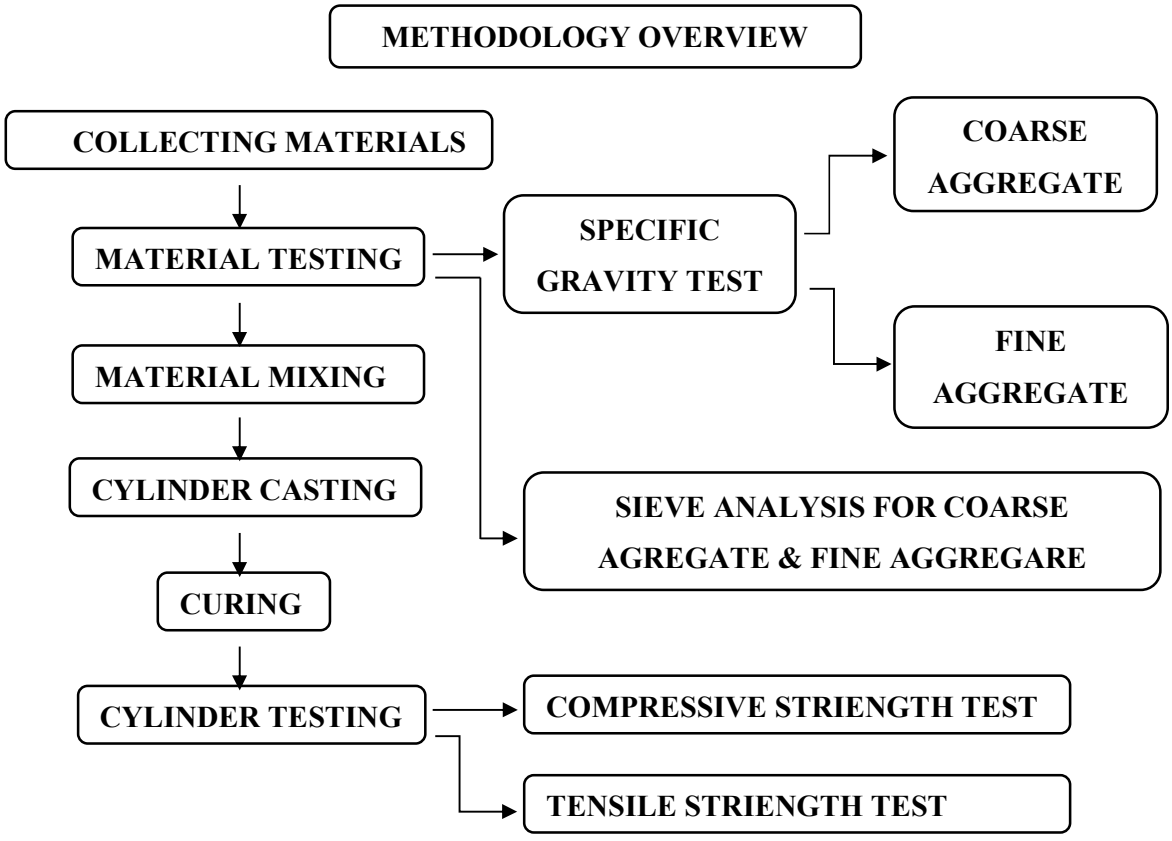


Figure 3.1: Flow Chart of Methodology overview

## 3.2 Materials

The description of the materials that used in research is given below.

### 3.2.1 Cement

Cement is a necessary aspect of concrete. Cement can also be is a binder, a substance utilized for improvement that sets, solidifies, and follows to specific substances to bind them together. Cement is seldom used on its own, however on the other hand to bind sand and gravel together. Cement blended with great combination produces mortar for masonry, or with sand and gravel, produces concrete Cements used in building are typically inorganic, frequently lime or calcium silicate based, which can be characterized as non-hydraulic or hydraulic respectively, relying on the capability of the cement to set in the presence of water. Plain Portland cement is used to make concrete blocks. About 30 kg of cement is required to whole the complete work.

Figure 3.2: Portland cement

### 3.2.2 Fine Aggregate (Sand)

Sand is a pulverized material settled of finely divided rock and mineral flecks. Sand has more than a few scribble nevertheless is described by way of its grain size. Sand grains are tinier than gravel and cruder than silt. Sand can additionally allude to a textural class of soil; i.e., a soil bearing greater than 85 percentage sand sized flecks through mass.The Structure of sand varies, depending on the surrounding rock production and position

however the most common component of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO2), usually in the shape of quartz. Sand is a non-renewable genre over human timescales, and sand compatible for making concrete is in high demand. Desert sand, even though plentiful, is no longer appropriate for concrete. 50 billion lots of beach sand and petrifaction sand is used every yr. for construction. 1.45 cft sand used to be required for this research.

Figure 3.3: Fine Aggregate (Sand)

### 3.2.3 Coarse Aggregate (Brick Chips)

Aggregate which are massive than ASTM #4 sieve or 4.75 mm are coarse Aggregates. it means to asymmetrical and pulverized materials such as struck Bricks , gravel, or broken stone are used for making concrete. In most cases, Coarse is naturally going on and can be gained via blasting quarries or impairing them by using hand or crushers.In our project we use 19mm down nicely graded 1st classification brick chips as Coarse aggregate..

Figure 3.4: Coarse Aggregate (Brick Chips)

### 3.2.4 Coconut fiber

Due to the quantity and availability of coconut fiber, it has come to be increasingly more frequent to use this material to strengthen concrete. Coconut fibers are a byproduct of coconut processing, and it can be produced cheaply and efficaciously anywhere in the world. Since concrete is the most often used construction material in the world, it would simply be really useful to discover methods to increase its stability and strength. Coconut fiber has been shown to be an tremendous material for reinforcing concrete, a treasured use for a byproduct of coconut processing. In addition, coconut fibers are lighter than the traditional coarse mixture so the resulting concrete will be lightweight. Therefore, it can be used as a excellent substitute of coarse aggregate to produce structural concrete in the development industry. Collect coconut fiber from the market then throughly clean the filth and other ingredients from the coconut fiber and separate the usable coconut fibers. Then with the help of scissors they are cut to around 1" size.

Figure 3.5: Coconut Fiber

### 3.2.5 Water

water is the key element which when compound with cement varieties a paste that binds the aggregate collectively the water motives the hardening of concrete via a process known as hydration use clean water amassed from local sources water and cement ratio have to be 40.

### 3.3 Test of Materials

Below is a description of the tests that performed on the material before use in concrete.

#### 3.3.1 Tests of course & fine aggregates

Aggregate is an important component of concrete. It carries the pressure exerted on the concrete. Aggregates usually contain 70-80% of the volume of concrete. Therefore, some tests need to be done before using this aggregate concrete. Two test is required before using aggregate on concrete. They are,

1) **Specific gravity test**
2) **Sieve analysis**

##### 3.3.1.1 Specific Gravity Test (Coarse Aggregate):

Specific gravity is the ratio of the weight of a given volume of aggregate to the weight of an equal volume of water. The specific gravity of aggregates indirectly measures its density; hence it is the most essential parameter of strength or quality of the aggregates. Higher the specific gravity, higher is the strength.

1 kg of brick chips was taken as coarse aggregate. From the coarse aggregate, the dirt and other element was cleaned and washed out properly. Immersed them in a pot of water at a temperature of 22°-33° Celsius for 24 hours. After 24 hours the weight was taken. Weight of Brick chips in water 'A'= 580 grams (excluding pot weight). Then remove the aggregate from the water and place it on a dry cloth. Then the aggregate is exposed to the atmosphere away from the direct sunlight. For not less than 10 minutes. The aggregate is weighted in air and the weight B=1120 gm. Then the aggregates should be kept inside the oven at a temperature of 100° Celsius for 24 hours and its weight should be taken. After 24 hours its weight C= 995 grams

$$\text{The specific gravity} = \frac{C}{B - A}$$

$$= \frac{995}{1120 - 580}$$

$$= 2.26$$

### 3.3.1.2 Specific gravity test for fine Aggregate (Sand)

300 grams of sand sample was taken for specific gravity test. Then an empty pycnometer was taken and weighed it. Weight of empty pycnometer W1= 0.155 gram. the pycnometer was filled with water up to the calibration mark and weighed the pycnometer with water. Weight of pycnometer with water W4 = 650 grams. Then filled the sand inside the pycnometer and took the weight of the pycnometer along with the sand. Weight of pycnometer with sand W2 = 300.115 grams. After taking the weight with the sand, again filled the inside of the pycnometer with water up to the calibration mark and took the weight of the pycnometer with the sand & water. Weight of sand, water and pycnometer W3= 829 grams. After getting all the weights, find out the value of specific gravity using the following formula.

$$\text{Specific Gravity of sand} = \frac{W2-W1}{(W4-W1)-(W3-W2)}$$

$$= \frac{300.115-0.115}{(650-0.115)-(829-300.115)}$$

$$= 2.47$$


Figure 3.6: Pycnometer and sand

### 3.3.2 Sieve analysis

Aggregates are amassed substances that are diluted with binding materials such as cement or lime for the manufacturing of mortar or concrete. Sieve analysis is one of the most necessary tests accomplished on-site. The sieve analysis is recognized as the gradation test, it is most integral test for all technicians and Engineers. Sieve analysis is the method of finding out the comparative proportion of a number particle sizes in an aggregate sample by way of passing the sample through a stack of trendy sieves arranged in descending order of their opening sizes. The sieve analysis determines the gradation (the ordination of aggregate flecks, by way of size, inside a given sample) in order to decide compliance with design, manufacturing control requirements, and verification specifications. Sieve evaluation also helps in finding out the fineness modulus of aggregates which shows instrumental in telling whether or not a mixture pattern is well-graded or not. In addition, the fineness modulus also shows the surface location of the mixture particles. However, there exists an inverse relation between aggregate surface area and the fineness modulus.

#### 3.3.2.1 Sieve Analysis for Fine Aggregate:

1) At first, measure 1000 gm of Sylhet sand sample for test. Then keep the sand on a clean pan
2) Break the sand into its individual particles with the fingers or wooden hammer
3) Then clean all sieve and arrange all the sieve.
4) Put the sample sand on the top pan of sieve
5) Then shake all sieves together by hand shaking using motion of horizontal rotations in a good way for a certain time
6) After shaking measure, the remnants of all the sieves and pans separately and noted the amounts in the notebook.

The recording of data for sieve analysis of sand sample and related calculations are shown in table given below.

Table 3.1: Sieve Analysis Lab Data for Fine Aggregate

| Sieve no | Retain |
|---|---|
| #4 | 0 gm |
| #8 | 43 gm |
| #16 | 288 gm |
| #30 | 362 gm |
| #50 | 236 gm |
| #100 | 51 gm |
| Pan | 20 gm |

**3.3.2.2 Sieve Analysis for Coarse Aggregate**:

1) Place All the sieve in decreasing order of their sizes keeping pan at bottom
2) Then measure 1000 gm of Brick aggregate for test. Then keep the aggregate on a clean pan
3) Now fill the sample to the highest sieve and sieve well for 10 minutes
4) After completion of sieving, then weigh the aggregates retained in each sieve and note it.

The recording of data for sieve analysis of Coarse Aggregate sample and related calculations are shown in table given below.

Table 3.2: Sieve Analysis Lab Data for Coarse Aggregate

| No. of Sieve | Wt. of Retain (gm) |
|---|---|
| #4 | 0 |
| #8 | 43 |
| #16 | 288 |
| #30 | 362 |
| #50 | 236 |
| #100 | 51 |

### 3.3.3 Fineness Modula's (FM)

The Fineness Modulus (FM) is an experimental figure acquired by accumulate the total percentage of the sample of an aggregate retained on each of a specified sequence of sieves, and dividing the sum by 100.

Very Fine Sand : < 2.2
Fine Sand : 2.2 - 2.6
Medium Sand : 2.6 - 2.9
Coarse Sand : 2.9 - 3.2

## 3.4 Molds

Molds utilized for planning tests are in understanding with the standard in the event that the taking after conditions fulfill:

1. Molds might hold their measurements and shape beneath all conditions of use.
2. A reasonable sealant such as overwhelming oil should be utilized where vital to anticipate spillage through the joints.
3. Positive implies might be given to hold base plates solidly to the molds.
4. Reusable molds might be gently coated with oil some time recently utilize.

### 3.5 Mixing of Concrete and Cylinder Preparation

i) Prepare 4 types of Concrete samples.

ii) 1st sample is plain cement concrete which has cement, sand and brick aggregates, 2nd sample contains 5% Coconut fiber of the volume of coarse aggregate, 3rd sample contains 10% coconut fiber of the volume of Coarse aggregate & 4th sample contains 15% coconut fiber of the volume of Coarse aggregate.

iii) Sample mixing ratio was 1:1.5:3

iv) Clean the cylindrical mold and ensure mold free from dust and rust.

v) Fill the mold with concrete in three equal layers by proper compaction with the help of a tamping rod.

vi) Keep the top surface of concrete smooth by the trowel.

### 3.6 Curing

i) Mold with concrete samples should be covered with wet gunny bags or keep it undisturbed water for 24 hours at a temperature of 27 ° Celsius ± 2.

ii) At the end of 24 hours take out the sample and remove the concrete samples from the mold and it should be immersed into the water for 7 or 28 days based on the test.

iii) Take out a sample from the water after 24 hours prior to the test and it should be in dry condition.

Figure 3.7: Concrete Cylinder

### 3.7 Test for Cylinder

There are 02 types of cylinder tests done for our project

i) Compressive Strength test

ii) Tensile Strength test

#### 3.7.1 Compression Test

The compressive strength test indicates the highest power that concrete can acquire in perfect conditions. The compression check measures concrete strength in the hardened state. Filed concrete specimens are prepared, cured and tested in accordance to ASTM general procedures. Specimens are prepared from concrete taken from different construction sites. The procedures and calculations that are used for measuring compressive strength of cylindrical concrete specimens is given below.

##### 3.7.1.1 Standard test strategy for compressive quality of cylindrical concrete exa-moles (ASTM Designation: A 370-03)

This test strategy comprises of applying a compressive hub stack to barrels at a rate which is inside the endorsed extend until disappointment happens. The compressive quality of the example is calculated by isolating the most extreme stack accomplished amid the test with the cross-sectional zone of the example. This quality is commonly indicated as characteristic quality of concrete measured at 28 days after blending.

##### 3.7.1.2 Concrete Barrel Stacking Samples Placing the Example:

The plain (lower) bearing piece is put with its solidified confront up one the table of the testing machine straight forwardly beneath the roundly situated (upper) bearing piece. The bearing faces of the upper and lower bearing squares are cleaned and the test example is set on the lower bearing block. Zero confirmation and piece seating. Earlier to testing the example it is confirmed that the stack marker is set to zero. On the off chance that the marker isn't legitimately set to zero it is adjusted. Rate of loading the stack is connected persistently and without shock. Standard indicate that for testing machines of the screw sort the moving head should travel at a rate of around 0.05in. (1mm) min when the machine is running sit out of gear. Whereas for using pressurized water worked machine, the stack might be connected at a rate of development (platen to crosshead estimation) comparing to a stacking rate on the example inside the extend of 20 to 50 psi/sec (0.15 to 0.35 Mpa / sec).


Figure 3.8: Compression Test

### 3.7.2 Tensile Strength of Concrete:

The concrete tensile strength is the capability of concrete to face up to tensile pressure or stress applied to it. The tensile strength of concrete is measured by using the split cylinder check of concrete method. The tensile power of concrete is measured by the Units of Force per Cross-Sectional vicinity (N/Sq.mm. or Mpa)

i) The bearing surfaces of the machine and the loading strip free from dust.

ii) The specimen should be weighed in Newton prior to the test.

iii) Now, place the specimen centrally between the loading strips and ensure the upper platen is parallel to the bottom platen.

iv) Then apply the load gradually until the specimen break and note down the Value.

v) The same method has been repeated for other samples


Figure 3.9: Tensile Test

### 3.8 Summary

A concrete mix was designed to achieve the minimum grade of M20 (by taking 1:1.5:3 as nominal mix) as required by IS 456 – 2000. The investigation was done by taking 5%, 10%, and 15% (by the volume of the coarse Aggregate) of coconut fiber in the concrete mix. Coconut fibers were obtained from local market. Minimum of two test specimen were taken for each analysis. The following tests were conducted on the respective specimens:

1. Splitting Tensile Strength on cylinder

2. Compressive Strength

# CHAPTER 4

# RESULT AND DISCUSSION

## 4.1 Introduction

That are guessing, that the compressive strength of concrete will be decreasing with an increase in the coconut fiber of the concrete mix. From the previous studies, it was found that for 1% and 2% fiber content there was an increase in tensile strength of concrete. (22)

When doing this experiment, the experiment was conducted on concrete with a mix containing 5%, 10% & 15% fiber, it was noticed that the tensile strength of concrete will decreasing with an increase in the coconut fiber of the concrete mix. Unexpected behavior with 15% coconut fiber, an unexpected variation in compressive strength of concrete with 15% fiber content was observed. It is another probable reason for the unexpected variation could be the mixing of concrete due to increased coconut fiber. Another reason could be reduction in the water content due to absorption of water by fiber improper bonding & creation of air voids.

## 4.2 Hardened Properties

### 4.2.1 Compressive Strength

The compression test shows the best possible strength concrete can achieve in perfect conditions. The compression test measures concrete strength in the hardened state. Filed concrete samples are prepared, cured and tested according to standard procedures. Specimens are prepared from concrete taken from different construction sites. Following processes and calculations are used for measuring compressive strength of cylindrical concrete specimens.

Compressive strength is defined as the resistance of concrete to axial loading. The results of compressive strength cylinders for 7 days and 28 days are shown in Table 4.1

Table 4.1: Compressive strength data of concrete cylinders

| Mixes | Days | Compressive Strength (MPa) | | Mean Strength (MPa) |
|---|---|---|---|---|
| | | 1 | 2 | |
| **0%** | 7 | 17.885 | 17.268 | 17.5765 |
| | 28 | 19.118 | 29.233 | 24.1755 |
| **5%** | 7 | 9.867 | 15.418 | 12.6425 |
| | 28 | 19.735 | 28.369 | 24.052 |
| **10%** | 7 | 9.251 | 14.185 | 11.718 |
| | 28 | 17.885 | 22.202 | 20.043 |
| **15%** | 7 | 17.885 | 15.418 | 16.651 |
| | 28 | 24.669 | 22.202 | 23.435 |

The chart shows that, compressive strengths are increasing after 28 days, it is more than compressive strengths after 7 days for all cylinder of any percent replacement. That means, if coarse aggregate is replaced by coconut fiber partially, then compressive strengths are more improved if 28 days of curing is done instead of 7 days. So that the compressive strength is increase d for more curing.

The compressive strength is measured using cylindrical specimens of 4” diameter and 8” mm height. In the Figure.4.4 shows the graphical position between compressive strength and replacement rate of the concrete cylinder specimen. The compressive strength of concrete with coconut fiber is found to be highest at 7 days, 28 days as compared with the concrete. It is observed that the variation in compressive strength of coconut fiber is decrease the value for all coarse aggregate replacement rate of 0%, 5%, 10%, 15% from 7 days. And In 28 days curing, the compressive strength values are almost similar with replacement of 0% ,5% and 15%, The 10% replacement of coconut fiber are decrease the value.

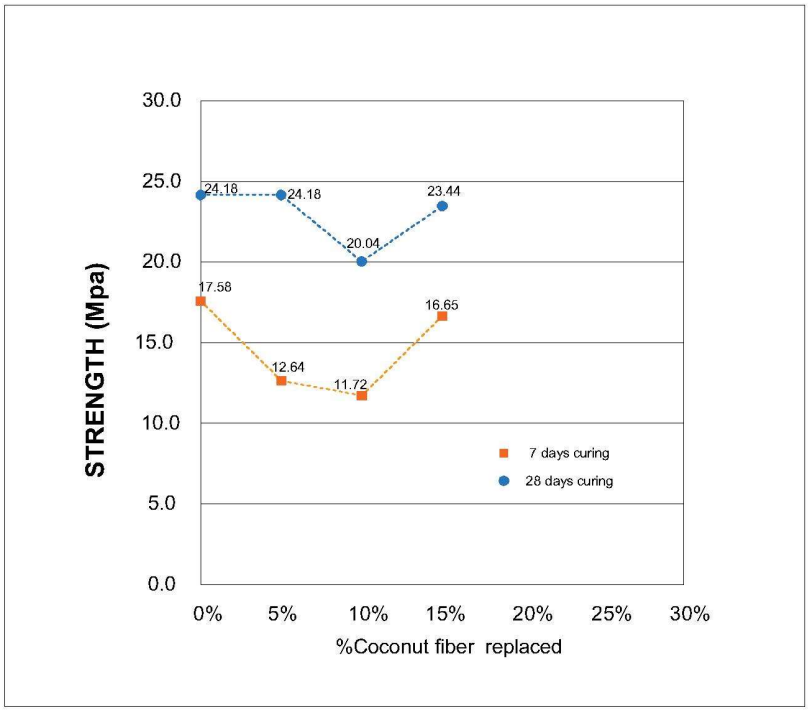


Figure 4.1: Compressive strength vs Coconut fiber replacement rate

Figure 4.5 shows the graphical plot between compressive strength and curing time of the concrete. It is observed that the compressive strength increases with increase in curing time. The strength gain in 7 days is not uniform. The 7 days strength is not high compared to 28 days. The rate of increment of compressive strength is more up to 28 days compared to the 7 days. It is observed that the compressive strength in 28 days is very closer in all replacement rates. The variation of compressive strength in 7 days is not uniform this may be due to the improper curing and mixing. The compressive strength increases with the increase of curing time.

### 4.2.2 Splitting tensile strength

One of the important properties of concrete is “tensile strength” as structural loads make concrete vulnerable to tensile cracking. Tensile strength of concrete is much lower than its compressive strength. It has been estimated that tensile strength of concrete equals roughly about 10% of compressive strength. Table 4.2 shows the results of the test.

Table 4.2: Splitting tensile strength data of concrete cylinders

| Mixes | Days | Splitting tensile Strength (MPa) | | Mean Strength (MPa) |
|---|---|---|---|---|
| | | 1 | 2 | |
| **0%** | 7 | 1.233 | 1.387 | 1.310 |
| | 28 | 2.004 | 1.758 | 1.881 |
| **5%** | 7 | 1.295 | 1.603 | 1.449 |
| | 28 | 1.911 | 1.696 | 1.803 |
| **10%** | 7 | 1.603 | 1.480 | 1.541 |
| | 28 | 1.634 | 1.727 | 1.680 |
| **15%** | 7 | 1.850 | 1.449 | 1.649 |
| | 28 | 1.665 | 1.881 | 1.773 |

The chart shows that, tensile strengths are increase after 28 days, it is more than tensile strengths after 7 days for all cylinder of any percent replacement. That means, if coarse aggregate is replaced by coconut fiber partially, then tensile strengths are more improved if 28 days curing is done instead of 7 days. So that the tensile strength is increase for more curing.

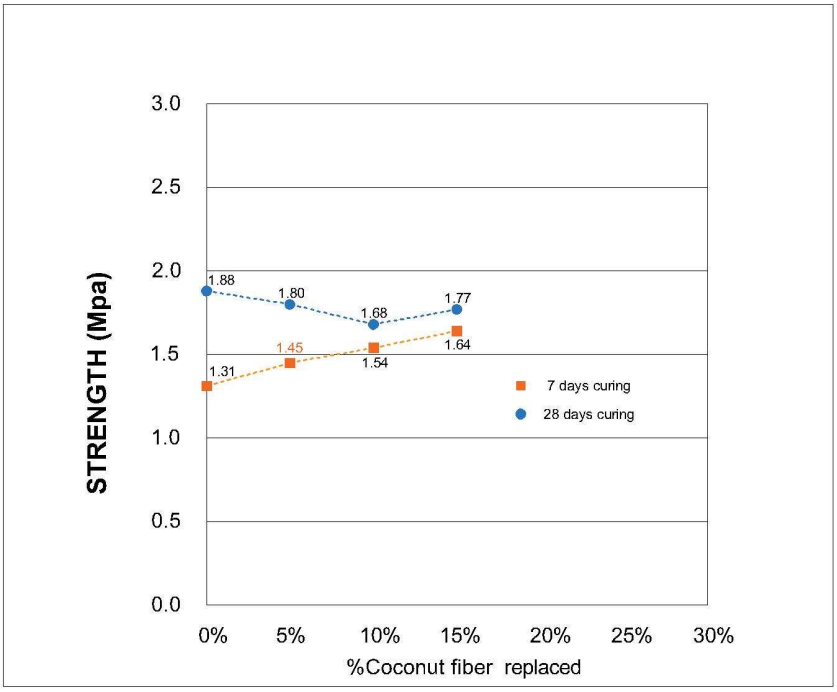


Figure 4.2: Splitting Tensile Strength vs % of Coconut fiber replacement rate

Figure 4.2 shows that after 7 days of curing with 5% coconut fiber, the value of tensile strength increased slightly compared to plain concrete and decreased after 28 days of curing. The same results were obtained after mixing 10% and 15% coconut fiber. In all cases, after 7 days of curing, the value is slightly higher than that of ordinary concrete, and after 28 days of curing, it is slightly lower or closer. So, the test results show that mixing coconut husk with concrete does not affect the tensile strength much more.

### 4.2.3 Sieve Analysis

A sieve analysis is an analytical technique used to determine the particle size distribution of a granular material with macroscopic granular sizes. The sieve analysis technique involves several layers of sieves with different grades of sizes. The finest sized sieve lies on the bottom of the stack with each layered sieve stacked above in order of increasing sieve size.

When a sample of granular material is placed on the top sieve and sifted, the individual particles of the material are separated onto the final layer that the particle could not pass through. The base of the instrument contains a shaker, which facilitates the filtering. Performing a sieve analysis is important when analyzing materials because their particle size distribution can affect a wide range of properties such as the strength of concrete, the solubility of a mixture, their surface area properties and even their taste .Table 4.3 & 4.4shows the results of this test.

Table 4.3: Fineness modulus of Fine Aggregate

| **DETERMINATION FM OF FINE AGGREGATE** | | | | |
|---|---|---|---|---|
| **No. of Sieve** | **Wt. of Retain (gm)** | **% Wt. of retain** | **%Cumulative Retain** | **F.M** |
| #4 | 0 | 0 | 0 | F.M = 297.6 / 100 = 2.97 |
| #8 | 43 | 4.3 | 4.3 | |
| #16 | 288 | 28.8 | 33.1 | |
| #30 | 362 | 36.2 | 69.3 | |
| #50 | 236 | 23.6 | 92.9 | |
| #100 | 51 | 5.1 | 98 | |
| Total | | | 297.6gm | |

Table 4.4: Fineness modulus of Coarse Aggregate

| **DETERMINATION FM OF COARSE AGGREGATE** | | | | |
|---|---|---|---|---|
| **No. of Sieve** | **Wt. of Retain (gm)** | **% Wt. of retain** | **%Cumulative Retain** | **F.M** |
| 3/4” | 448 | 44.8 | 44.8 | F.M = $\frac{320.96}{100}$ = 3.32 |
| 3/8” | 472 | 47.2 | 92 | |
| #4 | 80 | .08 | 92.08 | |
| Pan | 0 | 0 | 92.08 | |
| Total | | | 320.96 gm | |

# CHAPTER 5

# CONCLUSIONS AND FUTURE STUDIES

## 5.1 Introduction

This experiment purpose to investigate the behavior of fresh and hardened properties of concrete mixes and the effect of coconut fiber as a replacement by volume of percentages in these mixes. Based on the limited experimental work carried out in the current study, the following conclusions may be drawn out and recommendations for future studies also presented in this chapter that may be taken in consideration.

## 5.2 Conclusions

- Coconut fiber have low in density reduces the overall weight of the concrete so we can used it as a structural light weight concrete.
- The value of compressive strength of concrete contain coconut fiber is slightly decreased. Its value is close to the compressive strength of ordinary concrete which can be used in construction work.
- The value of tensile strength of concrete contain coconut fiber is slightly decreased than concrete containing natural aggregate.
- The noted thing is that the coconut fiber can be used in the concrete, it can get freely available or negligible price which will make the concrete economically and financially affordable.

## 5.3 Future Scope of Study

- Flexural strength of concrete can be experimented.
- Certain admixtures such as air entraining agents and super plasticizers can be used to improve the flow characteristics of concrete.
- Fire resistance of concrete can be examined.

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