

# Study on Effect of Banana Fiber on Performance of Soil Cement Brick

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**Abstract** - In recent years the great challenge in our country is to construct a low-cost building. Decreasing the cost and increasing the strength is done by reinforcing the locally available fiber materials. The main objective of this study is to expose the importance of banana fiber as reinforcement in brick masonry. By using the agricultural materials such as natural fiber will increase the mechanical properties of brick. Nowadays engineers are attracted by fiber reinforced brick. The ultimate theme of our paper is to review the scope of banana fiber in soil reinforcement brick. Banana fibers are eco-friendly and are low in cost and have high tensile and flexural strength. Local engineers use banana fiber reinforced composites because of its low cost and durability but on sub structural building. Our motive is to spread awareness of banana fiber as a construction material in civil engineering construction works. Compression test are done to find the strength of the material. It has been clearly noted that adding fiber will slightly increase in strength. The flexural strength of banana fiber reinforced brick increases when compared with ordinary conventional brick. From this project we have finally concluded that banana fiber reinforced brick is more effective than normal brick.

**Key Words:** Density<sup>1</sup>, Compressive Strength<sup>2</sup>, Banana Fiber<sup>3</sup>, Soil<sup>4</sup>, Cement<sup>5</sup>, Water<sup>6</sup> etc

## 1. INTRODUCTION

To overcome the defects natural fibres are used as a reinforcement in Cementitious materials by modern engineers. To resist propagation of cracks and to improve the ductility behaviour of brick fibres are distributed randomly in cement mortar. The generally used fibres are banana fiber, jute. The banana fiber is the most prominent due to its easy availability and better durability in comparison to other natural fibers. This paper presents the study of the effect of inclusion of untreated banana fibers on stress strain behavior of the clay reinforced with dry or untreated fibers in random arrangement for possible use in making bricks to construct mud houses in rural India. A few years back, the use of fibers as an admixture to replace certain aggregates has grown rapidly mainly due to economic factors, climatic conditions. Various types of agriculture waste, after being processed, have been tested by blending with another common compounds (soil, cement and water) to make composite construction materials. One of the important effects of the inclusion of natural fibers in the soil

matrices is to protect shrinkage cracks due to drying process.

## 1.1 OBJECTIVES

To find the amount of load withstand by the banana reinforced brick.

1. To find the variation in compressive and flexural strength of brick.
2. To find the ability to resist crack and spall.

## 1.2 SCOPES

The natural banana fiber can be the effective material to reinforce concrete strength which will not only explore a way to improve the properties of brick, it will also explore the use of banana fiber and restrict the utilization of polymer which is environmental detrimental.

Banana absorbs 30% more water than peat and is much easier to rewet. Since it absorbs more water it assists in hydration process of cement.

## 2. MATERIALS USED

### 2.1 CEMENT

Cement is a powdery substance made from clay and limestone. It is used to build structures because of its strength. Here ordinary Portland cement of 33 grade IS269:1989 is used in manufacture of brick. It is also a binder which are low in cost and gives high strength. Due to its low maintenance and high durability it is used everywhere.

**Table-2.1: CHEMICAL AND PHYSICAL PROPERTIES OF CEMENT**

CHEMICAL PROPERTIES	PHYSICAL PROPERTIES
SiO <sub>2</sub> -23.5%	Relative Density -3.15
CaO -47.0%	Consistency -28%
MgO -1.74%	Loss on Ignition -<4%



Fig-2.1: Cement

### 2.2 BANANA FIBER

Banana fiber is a naturally occurring fiber obtained from banana plant or plantain plant. The main advantage of banana fiber is its mechanical properties and its stiffness. Banana fiber ligno-cellulosic fiber obtained from the pseudo stem of the plant. It is a highly strong fiber with less weight.

Table-2.2: CHEMICAL AND PHYSICAL PROPERTIES OF BANANA FIBER

CHEMICAL COMPOSITION		PHYSICAL PROPERTIES	
Lignin	-15%	Density	-1350kg/m <sup>3</sup>
Cellulose	-62%	Flexural modulus	-4Gpa
Moisture regain	-13%	Tensile strength	-56Mpa



Fig-2.2: Banana fiber

### 2.3 AGGREGATE

Soil is used as aggregate in brick manufacturing. It occupies 90% of the brick volume. The soil used in brick manufacturing should be fine and passes through 1.15-micron sieve size. Red soil is used mainly because it gives bright red colour to the brick. The mixture should contain one third of clay and two third of sandy soil.

Table-2.3: CHEMICAL AND PHYSICAL PROPERTIES OF AGGREGATE

CHEMICAL PROPERTIES		PHYSICAL PROPERTIES	
pH	-5.5-7.0	Colour	-varies
Soil bases saturation	-100%	Texture	-varies
Soil acid	-2.5-10.0	Density	-2.65gm/cm <sup>3</sup>



Fig-2.3: Aggregate

### 2.4 WATER

The very important ingredient for binding composites is water. Normal portable clean water is used in the manufacture of brick. The strength of the soil cement brick depends mainly on the binding action which will be influenced by the water. Water causes the hardening of cement through a process called hydration. Too much of water reduces the strength of the brick. so it is important to add water in an required level.

Table-2.4: CHEMICAL AND PHYSICAL PROPERTIES OF WATER

CHEMICAL PROPERTIES		PHYSICAL PROPERTIES	
Alkalinity	-20-200mg/l	Viscosity	-0.0091poise
Hardness	-varies	Heat capacity	-4.186j/g <sup>0C</sup>
Heat of vaporization	-540cal/g	Density	-997kg/m <sup>3</sup>

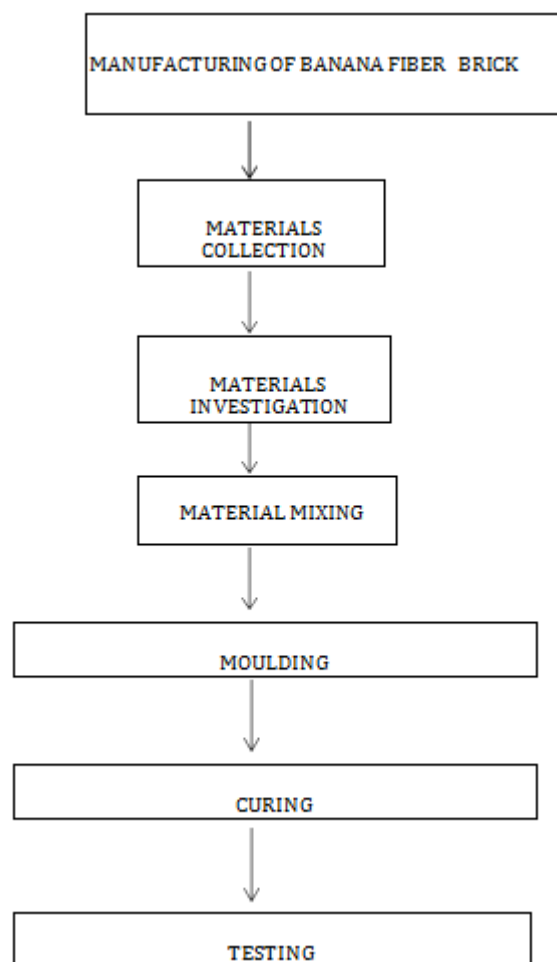


Fig-2.4: Water

### 3. LITERATURE REVIEW

1. LIHOLT et al. reported on the different natural organic fibers and provides the information about the composition and physical properties of natural fibers.
2. ROGER et al. discuss the factors affecting the agro fibers and found that the chemical compositions and physical properties of them depends on part from which fiber is extracted.
3. IDICULA et al. study the physical properties of natural fibers were mainly determined by their physical and chemical composition such as structure of fibers, cellulose content, angle of fibrils, cross section and the degree of polymerization.
4. SALIT studied the background of importance of natural fibers. The advantages and disadvantages of the tropical natural fibers are listed. The information about fiber extraction process, the applications of fibers and other important topics are discussed.
5. JOSEPH et al. studied the physical properties of natural fibers and concluded the physical property of natural fibers depend mainly on the nature of the plant, locality in which is grown, age of plant, and extraction method is used.

### 4. METHODOLOGY



### 5. EXPERIMENTAL STUDY

#### 5.1 MATERIALS AND MIX PROPORTIONS

Locally available materials namely ordinary Portland cement 33 grade, fine aggregate and portable water are used in this manufacturing process. Natural fibers such as banana fibers of length 3cm and uniform diameter is taken. Banana fiber is presoaked in water because of its water absorption capacity.

Table-5.1: MIX DESIGN

MATERIALS	SOIL	CEMENT	BANANA FIBER
MIX PROPORTION	10	1	0.5&1
WEIGHT	3Kg	0.3Kg	5g&10g



## 5.2 MIXING

Hand mixing was used for convenient handling of banana fibers. The above mixer is mixed in correct proportion by adding approximately 500ml of water. The banana fiber is added to the replacement of soil. Mixing procedure was felt to be extremely tedious due to formation of small lumps. In order to avoid the formation lumps the fibers were added a small piece and randomly oriented in the mix.



Fig-5.1: Mixing

## 5.3 CASTING

Oil is applied inside the mould for the free removal of brick. The moulds are half filled with the above mixed specimen and compacted heavily to remove voids in the bricks. The remaining space is filled with mixed mortar and again compacted to make it flat and smooth surface.



Fig-5.2: Casting

## 5.4 CURING

The specimens were stripped from the moulds after casting and placed in a wet jute bag. Curing process is done until testing. Testing is done on third, seventh and 28th days from manufacturing.

## 5.5 RESULT

The deviation percentage of compressive strength of banana fiber reinforced brick to normal brick in two different mix ratios 10:1:0.5 and 10:1:1 and 10:1 are represented in graph.



Fig-5.3: Un burnt brick

## 6. CONCLUSION

Compression test are done to find the strength of the material. It has been clearly noted that adding fiber will slightly increase in strength. The flexural strength of banana fiber reinforced brick increases when compared with ordinary conventional brick. From this project we have finally concluded that banana fiber reinforced brick is more effective than normal brick.

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