Effect of Banana Fiber on Concrete Strength

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Abstract- *Concrete reinforcement technology is not new and fibers have been used for reinforcement since ancient times. Popular fibers are made up of steel and glass, while plastic and nylons have a limited use. Quantities, concentration, and dispersal influence the properties of Fiber reinforced concrete.*

Fiber reinforced concrete is a type of concrete that includes fibrous substances that increase its structural strength and cohesion. Fiber reinforced concrete has small distinct Fibers that are homogeneously dispersed and oriented haphazardly. Fibers used are steel Fibers, synthetic Fibers, glass Fibers, and natural Fibers. The characteristics of Fiber reinforced concrete are changed by the alteration of certain factors: type and quantity of Fibers, geometric configuration, dispersal, direction, and concentration.

Keywords- Banana Fiber, Concrete With Banana, Compressive Strength

I. INTRODUCTION

The word concrete has its origin from the Latin word “concretus”, which means to grow together. It is a rocklike material that is produced by mixing fine and course aggregates. British engineer John Smeaton made the first modern concrete in the year 1756. He added pebbles as the coarse aggregate with brick powder. Concrete is the material that is the most consumed by human after water. The present consumption of concrete in the word is estimated to be approximately 12 million tons per annum.Concrete has been around for centuries. It is believed that the Romans used concrete that is similar to the ones that are in use today. The need for it never seems to diminish as it is what this modern world is built on. The structures we see today are all made on it. The need for concrete is always changing, thus enabling modification to be made on the different type of concrete that exist today in order to conform to the surrounding and the times

1.1 Benefits of Fiber concrete over plain cement concrete:-

The use of natural Fiber to enhance the strength and applications of concrete . These natural Fibers have excellent physical and mechanical properties and can be utilized more effectively. They are economical (zero cost), with no chemicals. The addition of banana Fibers significantly improved many of the engineering properties of the concrete notably compressive strength, tensile strength, flexural strength. The ability to resist cracking and rupture were also enhanced. Thus acts as a natural admixture giving additional properties to the ordinary cement concrete.

II. LITERATURE REVIEW

2.1 FIBER

Based on the previous research work , a comparison of strength properties of Fiber reinforced concrete with the respect to conventional concrete and their influence of the shape and length of the Fiber on strength are also studied. Tests are conducted using passed coconuts Fiber of the length 5cm and raw Fiber meshes on size 5cm x 5cm after coating with the coconut oil at varying Fiber contain of 4%, 5% and 6%. A similar quantity of untreated Fiber is also use to compare in the influence of shape and length f the Fiber.

(BHATIA, 2001) studied the usefulness of the Fiber reinforced concrete in various civil engineering applications. Fibers include steel Fiber, natural Fiber and synthetic Fiber each of which lends varying properties to the concrete. The study revealed that the fibrious material increase the structural integrity. These studies made us adopt natural Fiber which are abundantly available and cheap.

(CHOUW, 2012) studies the visibility of using coconut Fiber ropes as vertical reinforcement in mortar-free law cost housing in earth quake prone regions. The rope anchorage is achieved by embedding it in the foundation and top tie beams. The bond between the rope and the concrete play an important role in the stability of the structure and the rope tensile is also found to be fairly high. The rope tension generated due to earth quake loading should be less than both the pull out force and the rope tensile load to avoid the collapse. The study

concluded the pull out energy increase with an increase in embedment length, rope diameter, cement and Fiber content in the matrix.

(KELLERET, 2005) investigating the shear behavior of reinforced concrete beam strengthened by the attachment of different configuration and quantity of the carbon Fibers. The study revealed that the strengthening by using carbon Fiber increased the resistance to shear and also spalling of the concrete.

(MAJID ALI, NEW ZEALAND) according to the research conducted, the mechanical and dynamic properties of coconut Fiber reinforce concrete members were well examined. A comparison between the static and dynamic moduli was conducted. , The influence of 1% , 2%, 3% and 5% Fiber content by mass of cement and Fiber length of 2.5cm, 5cm and 7cm is investigated. Noor Mohammed Sadiqul Hasan, from Malaysia have investigated the physical and mechanical characteristics of concrete after adding coconut Fiber on a volume basis.

III. MATERIAL PROPERTIES

3.1 CEMENT

Cement is an binding material which used is construction industry. cement sets well under water and hardens quickly and attains strength. cement differ from limes by the property that is does not slake but sets readily. cement possesses hydraulic properties to a great extent and acquires more strength on cement is an calcarious substance which is used in mortar or concrete for construction. The initial setting time of cement should not be less then 30 minutes and the final setting time should not exceed 10 hours.

The first importance of binding material for civil engineering construction was made by the romans. They discovered some lump of limestone found in clay bends. By burning these lump the roman engineers obtained a cementing material, called as roman cement.

3.2 SAND

Sand is a natural unconsolidated granular material. Sand is composed of sand grains which range in size from 1/16 to 2 mm (62.5…2000 micrometers). Sand grains are either mineral particles, rock fragments or biogenic in origin. Finer granular material than sand is referred to as silt. Coarser material is gravel. Majority of sand is dominantly composed of silicate minerals or silicate rock fragments. By far the most common mineral in sand is quartz. Hence, the term “sand” without qualification is imagined to be composed of quartz mostly. However, sand is a natural mixture which means that it is never pure. By no means can one say that quartz and sand are the same thing. Consolidated sand is a rock type known as sandstone.

3.3 AGGREGATES

Aggregates is the major ingredient of concrete. Aggregate are divided from rocks. They are broadly divided into two categories i.e., fine and course aggregate. Their properties are depend on the mineralogical composition of rocks. Crushed rocks are used as course aggregate and river sand as used as fine aggregate.

Aggregate occupy 70 to 80 percent of the volume of concrete. Physical characteristics and in some cases, chemical composition of aggregate affect the properties of concrete in its plastic and hardened state. It concrete, cement reacts with water and the ensuring cement paste sets as the hardens resulting into shrinkage. However aggregate improve the volume stability and durability of concrete. Aggregate are much cheaper then the cement. There for maximum economy and specified quality of the concrete can be achived by proper selection and gradient of aggregate.

3.4.Water

Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully. Potable water is generally considered satisfactory. In the present investigation, tap water was used for both mixing and curing purposes.

3.5 FIBER

Natural Fibers are defined as substances produced by plants and animals that can be spun into filament, thread or rope and further be woven, knitted, matted or bound. The most viable structural Fibers typically derive from specifically grown textile plants and fruit trees. Flax is knows as one of the foundation crops of our modern civilization. Thus Bcomp managed to combine historical legacy with the most advanced top-notch technologies and start a green revolution where historical resources for most advanced technologies are used. Nowadays, natural Fibers are more up-to-date than they have ever been, as they show outstanding mechanical properties and are 100% sustainable. Flax, jute and balsa are the natural Fibers we chose as basic materials for our supreme products. Natural Fiber composites with significant reduction in weight

became a serious alternative to conventional composite materials like glass and carbon Fibers.

Types of Fiber

There are many types of Fiber, we have used

Banana Fiber

Banana plant not only gives the delicious fruit but it also provides textile Fiber, the banana Fibers. It grows easily as it sets out young shoots and is most commonly found in hot tropical climates. All varieties of banana plants have Fibers in abundance. These Fibers are obtained after the fruit is harvested and fall in the group of bast Fibers. This plant has long been a good source for high quality textiles in many parts of the world, especially in Japan and Nepal.

Figure 1 BANANA FIBER

IV. EXPERIMENTAL INVESTIGATION

4.1 Concrete making (without fibers)

4.1.1Materials used

Cement
Sand (fine aggregate) Coarse aggregate
Coconut Fibers and banana Fiber Water

Cement

In this project we have used the OPC cement. The property is according to the IS code. It is act as a bending material.

Fine Aggregate

Good quality river sand, free from silt and other impurities and which is locally available, was used in this study.

Coarse Aggregate

The coarse aggregate used was a normal weight aggregate with a maximum size of 20mm and was obtained from the local supplier and it was tested in accordance with IS: 2386-1964.

Concrete making of plain cement concrete: -

1. To prepare concrete of M20 grade suitable for RCC, mix one part of cement,1 1/2parts of sand and 3 parts of coarse aggregate with water and mix thoroughly to make it homogeneous.
2. Water should be added as per required workability . Never use excess water to make the mix more workable.
3. Than mix the concrete by hand over the firm ground free from dust and other foreign material.
4. Thoroughly mix all the ingredients of concrete using trowel.

Concrete making using Fibers

Materials used

1. Cement
2. Sand (fine aggregate)
3. Coarse aggregate
4. Coconut Fibers and banana Fiber
5. Water

Cement

In this project we have used the OPC cement. The property is according to the IS code. It is act as a bending material.

Fine Aggregate

Good quality river sand, free from silt and other impurities and which is locally available, was used in this study.

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Water

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present investigation, tap water was used for both mixing and curing purposes.

Banana Fiber

Banana plant not only gives the delicious fruit but it also provides textile Fiber, the banana Fibers. It grows easily as it sets out young shoots and is most commonly found in hot tropical climates. Banana Fiber produced from the stem of banana tree by drying it. It is then add 0.5%,1% and 1.5 % by weight of cement

Procedure of mixing of concrete using Fibers

1. Firstly take the 6 moulds of size 15cmx15cm15cm.
2. Clean and reins this moulds. And oil or grease to this moulds that th will not able to stick on them.
3. Now mix the concrete of M20 grade that the cement, sand and aggregate are in ratio of 1:2:4 .
4. Now add 0.5% of banana Fibers of about 5cm. in length to that concrete.
5. We have done for different 3 proportion i.e. 0.5% ,1%.and 1.5% coconut Fiber is added to the concrete of same grade in 3 types.

This is mixed gently together and then it is allowed to place in that moulds.

V. RESULT AND DISCUSSION

Sr. no	Description	Compressive strength N/MM^2	Average N/MM^2	remark
1	Plain	22	18.07	7days
		11.11		
		21.11		
2	Plain	21.78	21.33	28days
		19.99		
		22.22		

Sr. no	Description	Compressive strength N/MM^2	Average N/MM^2	remark
1	0.5%Banana Fiber	20	20.15	7days
		21.78		
		18.67		
2	0.5%Banana Fiber	20	21.50	28days
		22.22		
		21.78		
3	1%Banana Fiber	21.78	18.73	7days
		13.33		
		21.11		
4	1%Banana Fiber	21.78	21.70	28days
		22.22		
		21.11		
5	1.5%Banana Fiber	22.22	18.90	7days
		17.78		
		16.70		
6	1.5%Banana	21.78	21.78	28days
justa econc	pply Fiber rete	21.33		
		22.22		

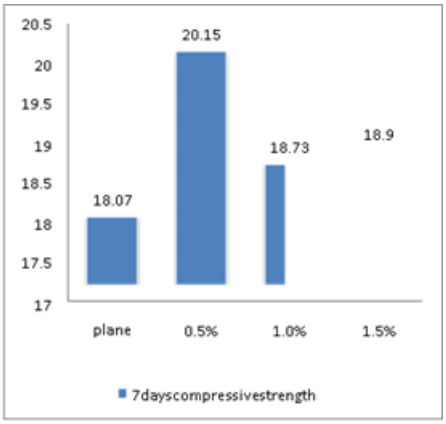

Figure 2 Banana Concrete Result For 7 Days

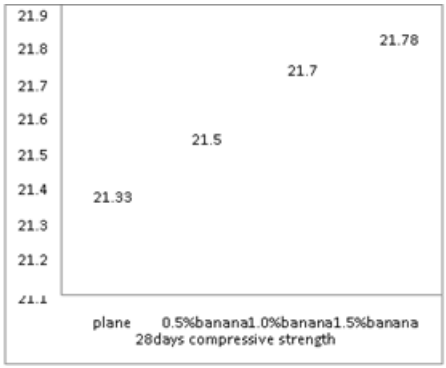

Figure 2 Banana Concrete Result For 28 Days

Discussion:-

Result shows that for the up to 0.5 % addition of banana fiber the overall strength of concrete is slightly increased as compare to the plain concrete Above 0.5% there is no difference in strength.

REFERENCES

[1] Walker, P.J. Strength and erosion characteristics of earth blocks and earth block masonry. J. Mater. Civ. Eng. 2004, 16, 497–506.

[2] Minke, G. The Building Material Earth in Modern Architecture. In Earth Construction Handbook; WIT Press: Southampton, UK, 2000.

[3] Prochazka, P.; Trčková, J.; Dolezel, V. Cement Mixture Reinforced by Polypropylene Fibres at Higher Temperature Conditions. In Proceedings of the 35th Conference on Our World in Concrete and Structures, Singapore, 25–27 August 2010.

[4] Bessadok, A.; Roudesli, S.; Marais, S.; Follain, N.; Lebrun, L. Alfa fibers for unsaturated polyester composites reinforcement: Effects of chemical treatments on mechanical and permeation properties. Compos. A 2009, 40, 184–195.

[5] Samrat, M.; Raul, F.; Yusuf, A. Banana fibers variability and fracture behavior. J. Eng. Fibers Fabr. 2008, 3, 39–45.

[6] Sandeep, K.; Varma, K. Degradation studies of polycaprolactone in banana fibers reinforced thermoplastics composites. J. Macromol. Sci. B 2006, 45, 153–164.

[7] Girisha, C.; Sanjeevamurthy; Guntiranga, S. Effect of alkali treatment, fiber loading and hybridization on tensile properties of sisal fiber, banana empty fruit bunch fiber and bamboo fiber reinforced thermo-set composites. Int. J. Eng. Sci. Adv. Technol. 2012, 2, 706–711.