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Experimental Study on the Properties of Banyan Stalks Reinforced Concrete

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Abstract: ***In this developing country day by day technology increasing rapidly "According to the development there is an increasing in the construction process". In construction the major role placed by concrete and steel. Due to wide ranging of steel usage the ore is also decreasing in the earth crust, so to avoid this type of scarcity or problems by using natural resources we can manufacture a fine quality reinforcing material for binding. In this process banyan tree stalks are the main component and we are not cutting the tree, just using AERIAL ROOTS of the banyan tree. If we cut them also, they can reproduce again by that tree. Banyan tree scientific name is "FICUS BENGHALENSIS" an annual fibre plant has been found to be an important source of fibers for a number of applications since good olden days. The banyan fibers has high potential as a reinforcing fiber and common home and office house tree, but in the wild forest, it's a giant tree of Indian Jungles. Banyan tree starts out life as an epiphyte growing on another tree where some eating birds deposited seed. Banyan tree can get 100 inches tall and, with its massive limbs supported by prop roots, spread over an area of several acres. A famous banyan tree near Poona, (India) is said to measure a half mile around its perimeter and be capable of sheltering 2000 peoples. Banyan trees are native to India, Srilanka and Pakistan. The literature review and tests we are conducting has shown scanty information on the application of this fibers as reinforcing material, keeping in view the easy availability of this new and a comprehensive research work has been initiated in our laboratory on synthesis study of properties of banyan tree stalks as a reinforcing binding material by adding some resins. The composites provide characteristics that are not obtained from any discrete material systems and cohesive structures made by combining two or more compatible materials, the present work presents the results of experimental investigations carried out to evaluate the effect of partial replacement of steel in the construction. To check the properties of the prepared specimen by the banyan tree stalks, we are doing Laboratory Tests i.e., Tensile and Hardness test. The test strength at 7, 14, 28 days then comparing the values with the steel and also materials tests are to be performed.***

Key points- Cement, Fine aggregates, Coarse aggregates, Banyan tree stalks, NAOH

I. INTRODUCTION

A. Banyan Tree

A banyan, conjointly known as spelled "banyan" may be a fig that begins its life as AN epiphytic plant i.e., a plant that grows on another plant, once it seeds germinates in a very crack or crevice of a bunch tree or edifice. "Banyan" typically specially designates "Ficus benghalensis" (The Indian Banyan), that is that the national tree of India, although name has also been generalized to denominate all fig that share a typical life cycle and used consistently in taxonomy to denominate the taxonomic category stigma subgenus stigma.

Fig no 1.1 Banyan tree

B. Characteristics

1) Older banyan trees are characterized by aerial prop roots that mature into thick woody trucks, which can become indistinguishable from the primary truck with age.
2) Old trees literally spread by using these prop roots to grow over a wild area. In some species, the prop roots develop over a considerable area that resemble a grove of trees, with every trunk connected directly or indirectly to the primary trunk.
3) The banyan is one of more than 750 species of fig trees, each of which is pollinated only by its own species of tiny wasps that breed only inside the figs of their partner trees.
4) Banyan are strangler figs. They grow from seeds that land on other trees and the roots they send down smother their hosts and grow into stout, branch supporting pillars that resemble new tree trunks.
5) For thousands of years, people have used banyans as sources of medicines.
6) Today in Nepal, people use banyan leaves, bark and roots to treat more than twenty disorders.

C. Cement

A cement is a binder, a substance used for production that sets, hardens, and adheres to different substances to bind them together. Cement is seldom used on its own, however alternatively to bind sand and gravel (mixture) together. Cement blended with great mixture produces mortar for masonry, or with sand and gravel, produces concrete. Concrete is the maximum extensively used cloth in life and is in the back of most effective water because the planet's maximum-fed on useful resource and is the maximum extensively used cloth in life and is in the back of most effective water because the planet's maximum-fed on useful resource and utilized in production are normally inorganic, regularly lime or calcium silicate based, which may be characterised as non-hydraulic or hydraulic respectively, relying at the capacity of the cement to set withinside the presence of water

Fig no 1.2 cement

D. Aggregates

Aggregates are available in nature in different sizes. These sizes of aggregate used may be related to the mix proportions, type of work etc. the size distribution of aggregates is called grading of aggregates.

Following are the classification of aggregates based on size: Aggregates can be classified into two types

1) Coarse aggregates
2) Fine aggregates

Fig no 1.3 &1.4 Aggregates

II. LITERATURE SURVEY

The increased environmental awareness and consciousness throughout the world has developed an ever-increasing interest in natural fibers and its applications in various fields. Natural fibers are now considered as serious alternative to synthetic fibers for use in various fields1. The use of natural fibers as reinforcing materials in both thermoplastic and thermoset matrix composites provide positive environmental benefits with respect to ultimate disposability and best utilization of raw materials. The advantages of natural fibers over traditional reinforcing materials such as glass fiber, carbon fiber etc. have their specific strength properties2, easy availability, light weight, ease of separation, enhanced energy recovery, high toughness, non-corrosive nature, low density, low cost, good thermal properties, reduced tool wear, reduced skin and respiratory irritation, less abrasion to processing equipment, renewability and biodegradability. It has been observed that natural fiber reinforced composites have properties similar to traditional synthetic fiber reinforced composites.

Natural fiber composites have been studied and reviewed by a number of researchers3 (Defense 1997; Defense and Vignon 1998; Mao et al 2000; Kaith et al 2003; Nakagaito et al 2004, 2005; Bhatnagar and Sain 2005). During the past decade, a number of significant industries such as the automotive, construction or packaging industries have shown massive interest in the progress of new bio composite materials. All these properties have made natural fibers very attractive for various industries currently engaged in searching for new bio composite materials. All these properties have made natural fibers very attractive for various industries currently engaged in searching for new and alternate products to synthetic fiber reinforced composites. The properties of natural fibers can vary depending on the source, age and separating techniques of the fibers. Ficus benghalensis, an annual fiber plant, has been found to be an important source of fibers for a number of applications since good olden days. The banyan fiber has high potential as a reinforcing fiber in polymer composites. Banyan tree is a common home and office house tree, but in the wild forests, it's a giant tree of Indian jungles. Banyan tree starts out life as an epiphyte growing on another tree where some fig-eating bird deposited a seed. Banyan tree can get 100 inches tall and, with its massive limbs supported by prop roots, spread over an area of several acres. A famous banyan tree near Poona,

III. METHODOLOGY

A. *Cement*

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. Cement is the most widely usedmaterial in existence and is only behind water as the planet's most consumed resource.

B. *Portland Cement*

Portland pozzolan cement includes fly ash cement, since fly ash is a pozzolan, but also includes cements made from other natural or artificial pozzolans. In countries where volcanic ashes are available (e.g., Italy, Chile, Mexico, the Philippines), these cements are often the most common form in use. The maximum replacement ratios are generally defined as for Portland-fly ash cement.

C. *Types of Portland Cement*

Portland blast-furnace slag cement, or Blast furnace cement (ASTM C595 and EN1971nomenclaturerespectively), containsupto95%groundgranulatedblast furnace slag, with the rest Portland clinker and a little gypsum. All compositions produce high ultimate strength, but as slag content is increased, early strength is reduced, while sulphate resistance increases and heat evolution diminishes. Used as an economic alternative to Portland sulphate-resisting and low-heat cements.

Portland-fly ash cement contains upto40% fly ash index ASTM standards (ASTM C595), or 35%under EN standards (EN197-The fly ash is pozzolanic, so that ultimate strength is maintained. Because fly ash addition allows a lower concrete water content, early strength can also be maintained. Where good quality

D. *Aggregates*

Aggregate is the component of a composite material that resists compressive stress and provides bulk to the composite material. For efficient filling, aggregate should be much smaller than ethe finished item, but have a wide variety of sizes. Construction aggregate, or simply" aggregate", Particulate material used in construction, including and gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates. Aggregates are the most mined materials in the world.

Aggregates are a component of composite materials such as concrete and asphalt concrete; the aggregates reinforcement to add strength to the overall composite material. Due to the relatively high hydraulic conductivity value as compared to most soils, aggregates are widely used in drainage applications such as foundation and French drains, septic drain fields, retaining wall drains, and road side edge drains. Aggregates are also used as base material under foundations, roads and railroads. In other words, aggregates are used as a stable foundation or road/rail base with predictable, uniform properties (e.g., to help prevent differential settling under the road or building), or as a low-cost extender that binds with more expensive cement or asphalt to form concrete

E. Water

Water act as lubricant for the fine and coarse-grained aggregates and reacts chemically with cement to form the binding paste for the aggregate and reinforcement. Water is also used for curing the concrete after it has been cast into the forms. Water used for mixing and curing shall be clean and free from injurious number of oils, acids, alkalis, salts, sugar, organic materials and other substances that may be deleterious to concrete or steel. Portable water may be generally considered satisfactory for concrete mix. Water found satisfactory for mixing is also suitable for curing concrete. However, water used for curing should not produce any objectionable strain or unsightly deposit on the concrete surface.Presence of tannic acid uric on compounds is objectionable. In the present investigation M25 grade concrete is used with a constant Water/Cement ratio of 0.5.

F. Banyan Tree

Banyan tree is characterized by a tangle of branches, roots and trunks. The tree, which may spread across several acres, is deeply rooted. The tree bears fruits, which look like figs. The fruits when matured appear red in colour and are not edible. Paper can be directly made from the wood and bark of the banyan tree. The roots of the tree are used to make ropes, which help to secure wood bundles. A strong adhesive, called shellac, is produced by the sap of the tree. Also, its sap is used as a medicine for treating external skin inflammations, dysentery, toothaches and ulcers. Its bark and seeds are used for producing a herbal tonic which can cool the body.

G. NAOH Solution

We are using NAOH solution for removing the impurities which are present on the banyan tree stalks. They are cutting the tree directly then removing the bark of the stalks dip them in the NAOH solution for 24 hours to remove the mud and soil particles.

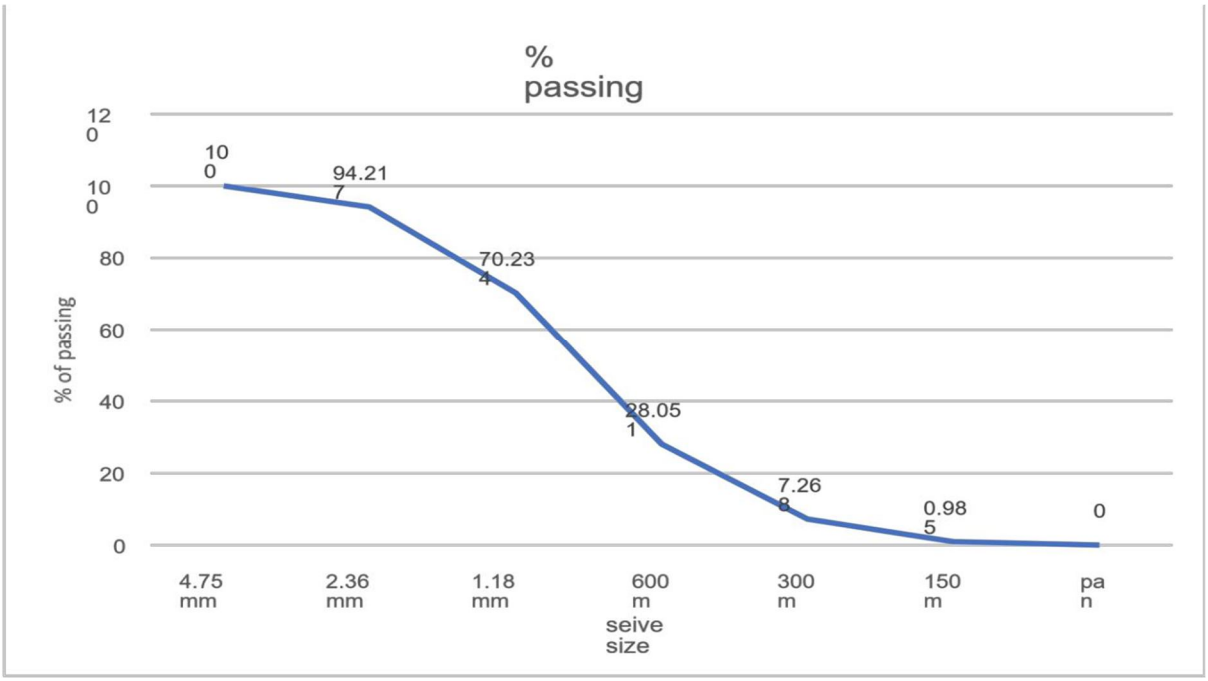

Fig.4.1 Sieve Analysis Graph

IV. EXPERIMENTALINVESTIGATION

A. Batching

Itistheprocessofmeasuringandcombiningtheingredientsofconcretesuchascement, water, fine aggregate, coarse aggregates, polypropylene fibers as per the mix design either by volume it's mass. For each mix design usage of weight balance machine for measuring the materials.

B. Mixing

Initially the cement and fine aggregates mixed thoroughly and to the mix the coarse aggregates are added then the polypropylene fibers are added and water to the mixer, until we get good workability, we should mix the materials properly are shown in figure 6.1 Properly mixed concrete is used for the casting.

C. Casting

For casting the specimen, the prepared concrete mixes are poured into the specified moulds and it filled by 3 layers and compacted the mixes by giving the 25 blows by using the tamping rod. After completing the poring, the top surface level should be finished smoothly. Keep the Specimen in the Vibrating Machine to remove voids in the concrete.

Fig.no.4.1 Mixing

Fig no: 4.3 After removing the voids cube moulds

Fig no: 4.4 Placing of moulds in surface

Fig no. 4.3 after removing voids cylinder mould

Fig no: 4.6 water curing

V. RESULTS AND DISCUSSION

A. *General*

In this chapter the parameters studied on the normal concrete and partial replacement of cement and coarse aggregates by using marble powder and demolished waste are discussed. The parameters such as compressive strength and split tensile strength and flexural strength are discussed and comparison between the normal concrete, marble powder and demolished waste are added concrete is represented.

B. *Compressive Strength*

The cube compressive strength test results at the various ages such as 7 days, 14 days and 28 days were carried out. Compressive strengths of various mix of marble powder and demolished aggregates 5%, 15% and 25%.

Table 5.1 Compressive strength test results for normal concrete

	Compressive Strength, MPa			
	Sample1 KN	Sample 2 KN	Sample 3 KN	Average N/mm^2
7 days	350	450	550	19.98
14 days	550	500	620	25.92
28 days	720	700	700	31.62

C. Split Tensile Strength

The Split Tensile strength test results at the age of 28 days were carried out. Split Tensile strengths of various mix of demolished aggregates 5%, 15% and 25%

Table 5.2 Split Tensile Strength for Normal concrete

Mix %	Split Tensile Strength, MPa	
	Sample1 KN	Formula Mpa ^{2} N/mm^2
7 days	175	2.47
14 days	200	2.82
28 days	220	3.25

D. Flexural Strength

Table5.3 Flexural Strength for Normal concrete

Normal Concrete	Flexural Strength, Mpa	
	Sample1 KN	$2\ fb = PL / b\ x\ d\ N/mm^2$
7 days	21	3.73
14 days	35	6.22
28 days	38	7.92

VI. CONCLUSION

Based on the experimental work it can be concluded that up to 20 % of sawdust can be used in concrete because it provides good strength. For Compressive and flexural strengths upto 15%sawdust shows good results whereas for split tensile strength, up to 20 % sawdust replacement can be made in concrete. The good strength shown by sawdust is due to its superior adhesion which captures and minimizes the splits occurring in the solid and also, the good pozzolonic property of the Fly Ash aids in this mechanism. The concrete also presents better ease of compaction as compared to that of control mix. Furthermore, the introduction of sawdust in the concrete also helps to reduce the improper disposing of the solid waste into landfills and thereby making the concrete eco-friendlier.

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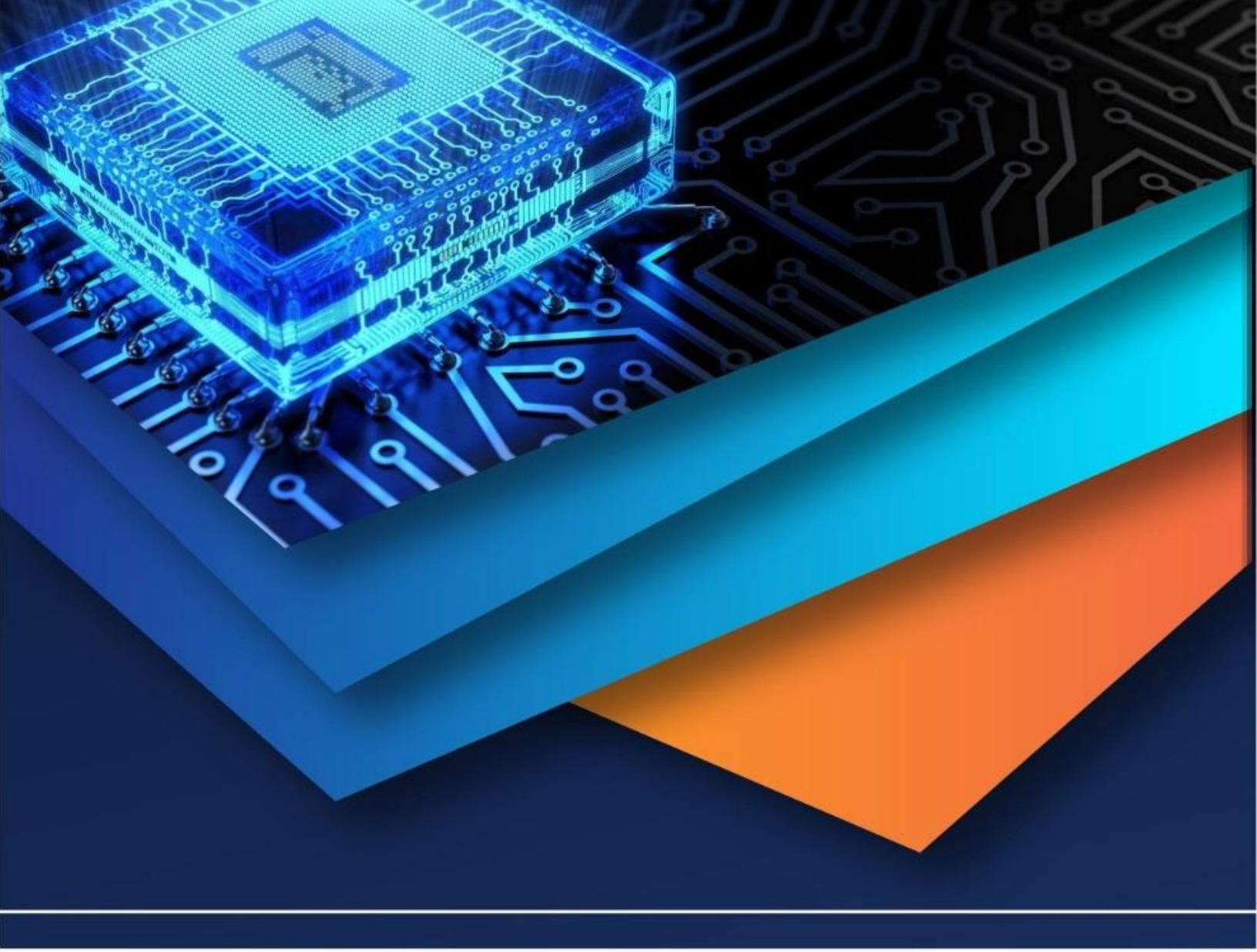

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