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AN EXPERIMENTAL INVESTIGATION OF PAVER BLOCK BY USING COCONUT FIBER WITH PARTIAL REPLACEMENT OF CEMENT

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Abstract - *Coconut fiber is a natural fiber extracted from the outer husk of coconut and used in products such as floor mats, doormats, brushes and mattresses. Coir is the fibrous material found between the hard, internal shell and the outer coat of a coconut. Applications of coconut fiber in paving block, which is quite economical, easy available and have desirable strength. Coconut fiber was added in proportion of 0.1%, 0.2%, 0.3%, and 0.4% in paver block. Coconut fiber was added as a partial replacement of cement in paver block. Then the paver block is tested for compressive strength. The result showed more strength as compared to paver blocks.*

Key Words: **Coconut fiber, Compressive strength, Flexural strength, Paver block.**

1. INTRODUCTION

Coconut fiber or coir fiber are found between the hard, internal shell and the outer coat of a coconut. The individual fiber cells are narrow and hollow, with thick walls made of cellulose. The coconut fiber is relatively waterproof, and is one of the few natural fibers resistant to damage by saltwater. The common name, scientific name and plant family of coconut fiber coir, cocos nucifera and Arecaceae. There are two types of coconut fibers extracted from matured coconuts and white fiber extracted from immature coconuts. The specific objective of this research is to find partial substitute of cement on paving block using coconut fiber so that it can raise some issues such as how many percentages of mixed substitution is needed to achieve the compressive strength. The properties of coconut fiber include excellent insulation against temperature and sound, unaffected by moisture and dampness, toughness and durability. Concrete responds to high temperatures produced by fire through cracking and spalling of concrete.

2. LITERATURE REVIEW

Shreeshail B.H. et al(2014)[1] have studied on the effect of coconut fibers on the properties of concrete. Study the deformation properties of concrete beams with fibers under static loading condition and the behavior of structural components in terms of compressive strength for plain concrete and coconut fiber reinforced concrete has been studied. The testing of various material constituents of concrete was carried out according to the Indian Standard specifications. The suitability of CFRC as a structural material is studied, in comparison with conventional concrete. Optimum results were found when 2% of coir by weight of cement fibers was used; there was 6% and 13% increase in compressive strength as compared to normal concrete for 75AR and 125AR respectively. Split tensile strength increased up to 12% for 75 aspect ratio and 29% for 125 aspect ratio with 2% fiber. Modulus of Rupture increased up to 45% for 75 aspect ratio and 50% for 125 aspect ratio with 2% fiber.

G. Navya et al (2014)[2] have carried out experimental investigation on properties concrete paver block with inclusion of natural fibers. In their experimental investigation the compressive strength, water absorption and flexural strength of paver blocks were determined by adding coconut fibers in the top 20mm thickness. Coconut fibers were added in proportions of 0.1%, 0.2%, 0.3%, 0.4% and 0.5% in volume of concrete. The compressive strength, flexural strength and water absorption were determined at the end of 7 and 28 days. They have been concluded that indicate the addition of coconut fiber by 0.3% paver block attains maximum compressive strength, i.e. addition of coconut fiber gradually increases flexural strengths and water absorption at 7 and 28 days. They investigated at 0.3% of coconut fiber content effect of top layer thickness on compressive strength and flexural strength is also determined.

Shivkumar Hallale et al, Shinde Swapnil et al, Mote Sumit et al, Vikas Londhe et al[3] the individual cellular structure is narrow and hollow, with thick walls of cellulose. It is pale in color at immature stage but with age becomes hardened and yellow with deposition of lignin layer. Each cell is about 1mm long with diameter 10-20µm. lignin content also imparts longevity to outdoor applications. Coir fiber is found between 10 to 30cm. coconut coir has about 48% of lignin resists bio-degradation, high takes more than 20 years to decompose.

Kumar et al[4] (2002) the researcher made this study to explore the use of coconut fibers and shells as an aggregate. Analyze the performance and effectiveness of the coconut fiber and shell as aggregates in concrete hollow blocks in terms of physical properties like color, texture, size and density and by mechanical properties like compressive strength, modulus of elasticity, absorption, thermal conductivity and fire resistance to obtain a design technical specification of concrete hollow blocks.

Reis et al[5](2006) investigated the mechanical characteristics (flexural strength, fracture toughness and fracture energy) of epoxy polymer concrete reinforced with natural fibers (coconut, sugarcane bagasse and banana fiber)

Fracture toughness and fracture energy of coconut fiber reinforced polymer concrete were higher than that of other fibers reinforced polymer concrete and flexural strength was increased up to 25% with coconut fiber only.

3. MATERIALS

1. Cement
2. Fine aggregate
3. Coarse aggregate
4. Water
5. Coconut fiber

4. PROPERTIES OF MATERIALS

4.1 Cement (OPC 43 grade)

Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials binding them together.

Table -1: Property tests on cement

4.2 Fine aggregate

Natural sand is generally used as fine aggregate silt and clay is also come under this category.

Table - 2: Property tests on fine aggregate

SI.NO	Properties	Result
1.	Specific gravity	2.65
2.	Water absorption	1.2%
3.	Fineness modulus	2.92
4.	Bulk density	1688kg/m^3

4.3 Coarse aggregate

In this, aggregate of size 20mm are used for all the specimens.

Table – 3: Properties tests on coarse aggregate

SI.NO	Properties	Result
1.	Specific gravity	2.75
2.	Water absorption	0.53
3.	Bulk density	1406kg/m^3

4.4 Coconut fiber

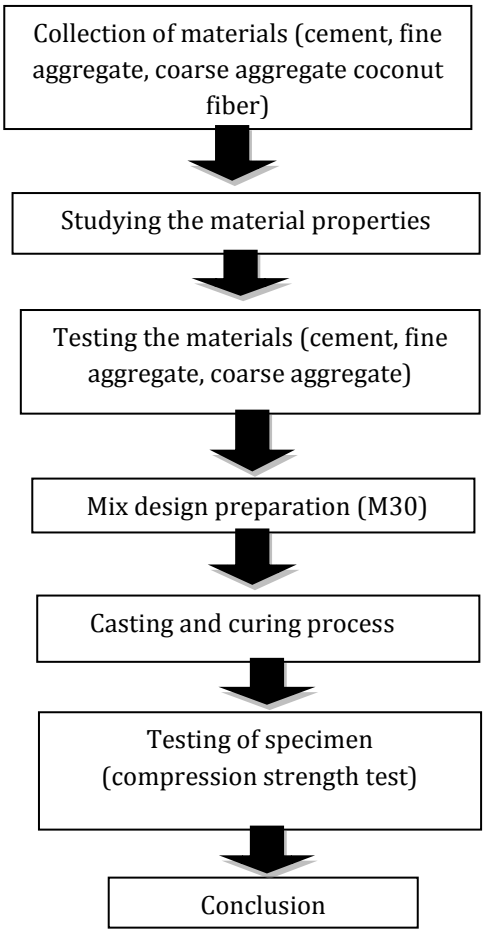
Coconut fiber is naturally abundant in nature, the husk from the coconut palm comprises of 30% weight of the fiber and 70% weight of the pith material. It can be used as alternative or additional material for cement, fine aggregate and coarse aggregate.

Table – 4: Property tests on coconut fiber

SI.NO	Properties	Result
1.	Specific gravity	1.23

Fig -1: Coconut fiber

5. METHODOLOGY



6. MIX DESIGN

Mix ratio as per IS method is adopted for the design mix. M30 grade of concrete is chosen and the design mix is adopted for the test specimen is 1:1.36:2.23.

7. PREPARATION OF SPECIMEN

The materials cement, fine aggregate, coarse aggregate added to it in a right proportion and mixed properly. Then the coconut fiber was added as a partial replacement of cement as 0.1%, 0.2%, 0.3% and 0.4%. Now the mixture is transferred to the mould and allowed to dry for 24hrs so that they harden. After drying the paver block is removed from moulds and allowed for curing. The curing is done for 7, 14 and 28 days.

Fig - 2: Paver block

8. TESTS ON SPECIMEN

Compressive strength test

Compressive strength (N/mm^2) =load (N)/Area (mm^2)

Fig – 3: Compression strength machine

Table – 5: Compression strength value

S. No	Percentage replacement of coconut fiber	7th day of compressive strength (N/mm^2)	14th day of compressive strength (N/mm^2)	28th day of compressive strength (N/mm^2)
1.	conventional	22.86	23.99	27.01
2.	0.1%	23.60	24.58	27.23
3.	0.2%	26.03	28.95	30.02
4.	0.3%	24.50	26.24	30.56
5.	0.4%	26.52	29.23	32.48

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