# Experimental Study on Utilization of Palm Fibre in Concrete

R. Dharini, G. Gokula Nandhini
UG student, Dept. of Civil Engineering,
Ramco Institute of Technology, Rajapalam.

Mrs. C. Subha,
M.E, (Ph.D) Assistant Professor,
Ramco Institute of Technology, Rajapalayam.

***Abstract:*** **The brittleness of cement matrices, such as those in concrete has always been a negative factor in the behaviour of structures because of the crack development. The aim of this study was the performance analysis of natural fibre reinforced concretes. The technique used consisted of distributing random, palm fibres at volume fractions varying from 0 to 4.25% in an ordinary concrete mix. Tests were performed for compressive and flexural strengths. A uniform scattering and distribution of the fibres in the concrete increased the resistance to cracking and shocks, and improved the ductility through absorption of energy. Research on durability, physical and mechanical properties of vegetal fibre reinforced concrete have shown that the maximum percentages, at the limits of utilization, are approximately at the level of the minimum percentage for the break even point. With regard to the size of components of the concrete, the fibres are best adapted for concretes with aggregate of a maximum diameter size situated between 8 and 15mm. Sandcretes are suitable for such fibre inclusions.**

***Keywords: Concrete, Fibres, Cellulose, Palm, Compressive strength, Flexural strength.***

## I. INTRODUCTION

The global use of concrete is second only to water. Concrete is a building material lmade from a mixture of broken stone or gravel, sand, cement, and water, which can be spread or poured into moulds and forms a stone-like mass on hardening. Concrete is a brittle material which shows high compression strength but low tensile strength. In order to overcome this fibres were introduced in the concrete. Fibre Reinforced Concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed suitable fibres. Fibre reinforced concrete are of different types and properties with many advantages. Fibre is a small piece of reinforcing material possessing certain characteristics properties. They can be circular or flat. The fibre is often described by a convenient parameter called “aspect ratio”. The aspect ratio of the fibre is the ratio of its length to its diameter. Typical aspect ratio ranges from 30 to 150.Fibre reinforced concrete (FRC) containing fibrous material increases its structural integrity. It contains short discrete fibres that are uniformly distributed and randomly oriented. Fibres include steel fibre, glass fibre, synthetic fibre and natural fibre. Within these different fibres that character of fibre reinforced concrete changes with varying concretes, fibre materials, geometries, distribution, orientation and densities.

## II. MATERIAL USED

The materials used for this experimental work are cement, palm fibre, aggregate, and water.

**Cement:** OPC of 43 grade and PPC were used with specific gravity 3.15 in this experiment conforming to I.S. – 12269- 1987.

**Fibre:** Palm fibre is added in the concrete and in terms of percentage (dry mix).

**Coarse aggregate:** 20 mm of crushed aggregate with specific gravity 2.781, moisture content 0.25% Water absorption 0.47%.

**Water**: Portable water was used for the experimentation.

## III. EXPERIMENTAL PROCEDURE

**Mix Design:** The proportions for normal mix of M20 Normal Mix are 1:1.5:3 with water cement ratio 0.45. In the present study method for mix design is the Indian Standard Method. The mix design involves the calculation of the amount of cement, fine aggregate and coarse aggregate in addition to other related parameters dependent on the properties of constituent material. The modifications are made and quantities of constituent materials used to cast Reinforced concrete.

**Workability Test:** Workability is carried out by conducting the slump and compaction factor test. As per I.S. 1199-1959 on ordinary concrete and waterproof concrete.

**Compressive strength test:** The compressive strength of concrete is one of most important properties of concrete in most structural applications. For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for M20 grade of concrete. After curing, these cubes were tested on Compression Testing machine as per I.S. 516-1959. The failure load was noted. In each category three cubes were tested for each trial batch and their average value is reported. The compressive strength was calculated as follows, Compressive strength (MPa) = Failure load / cross sectional area.

**Specific gravity test aggregate:** This test helps in determining the specific gravity of both fine and coarse aggregate sample by determining the ratio of the weight of a given volume of aggregate to the weight of an equal volume of water. It is similar in nature to the coarse aggregate specific gravity test.

**Water Quality Test:** There are various tests on water to

check its quality for suitability of concrete construction. These tests on water for concrete construction is discussed. Quality of water for construction use is determined in the laboratory. This test is done as per clause 3.1.1 of IS 3025. Water from each source shall be got tested before the commencement of work Following are the tests required for quality of water for Concrete construction purpose:

1. pH value test
2. Hardness test
3. Turbidity test

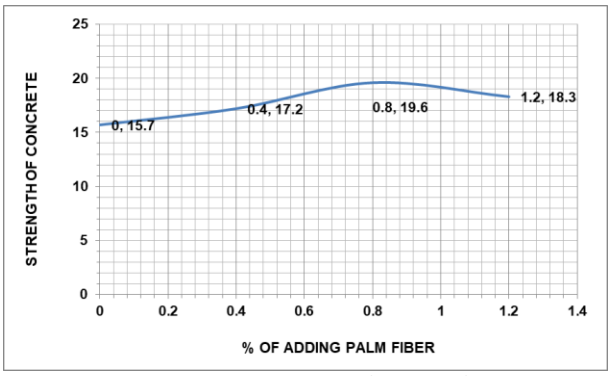
**Water absorption test:** Water absorption test helps to determine the water absorption of coarse aggregates as per IS: 2386 (Part III) – 1963. For this test a sample not less than 2000g should be used. . This permeability test should be considered as the dominant test to evaluate the case whereby concrete is subjected to hydrostatic pressure. Attack by sulphate, acids and chlorides induce electrochemical corrosion of steel reinforcement. Since this attack takes place within the concrete mass, the attacking agent must be able to penetrate through the concrete, which should be permeable. Permeability who defined it references the ease with which water can travel through concrete. There is no prescribed test by ASTM and BS for permeability but there is one in DIN 1048.

## IV. EXPERIMENTAL RESULTS

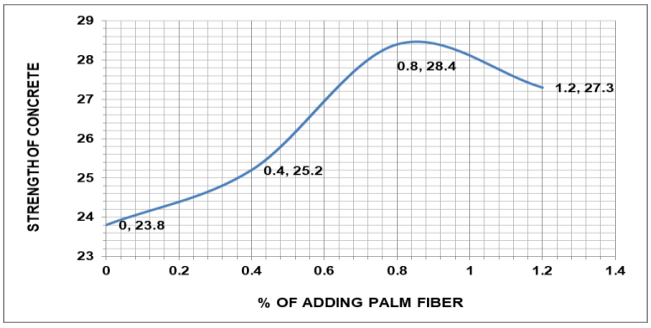
**Hardened concrete**:

The hardened concrete specimen properties are checked by compressive strength, split tensile strength and flexural strength.

**Compressive strength**: The compressive strength of cube specimens are checked for 7 & 28 days in compressive testing machine.

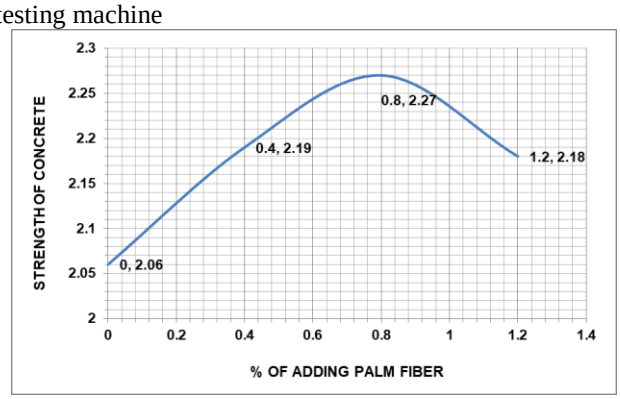



Graph no:1 Compressive Strength of Concrete for 7 Days

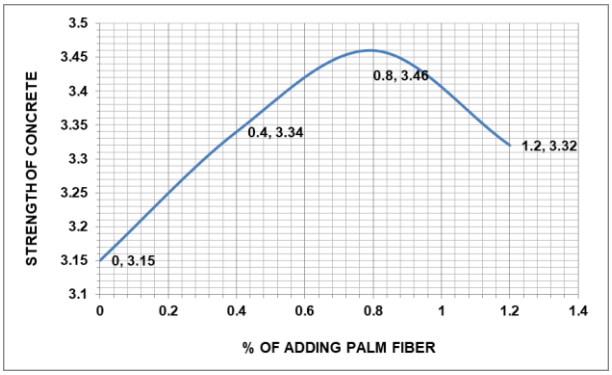



Graph no: 2 Compressive Strength of Concrete for 28 Days

**Split Tensile Strength Test:** The Split Tensile strength of Cylindrical specimens are checked for 7 & 28 days in testing machine



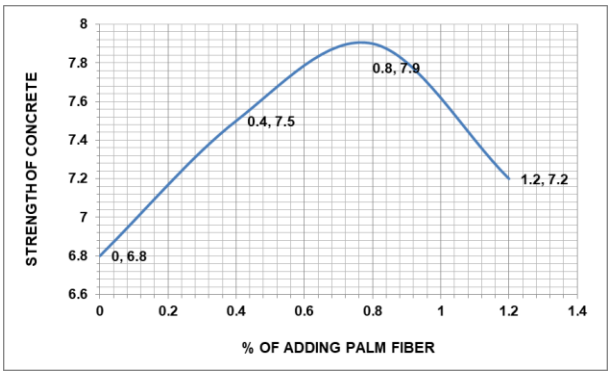

Graph no: 3 Split Tensile Strength of Concrete for 7days




Graph no: 4 Split Tensile Strength of Concrete for 28days

*Flexural Strength Test:*

To determine the Flexural Strength of Concrete, which comes into play when a road slab with inadequate sub-grade support is subjected to wheel loads and / or there are volume changes due to temperature / shrinking.




Graph no: 5 Flexural Strength of Concrete for 28 Days

## V. CONCLUSION

All OPC and PPC Concretes with IWP-1 & IWP2 compounds had more or less equal slump, retention and flow properties and also most of the PPC concretes with IWP Compounds had **better rheological properties** when compared to concrete without IWP compounds. The overall compressive strengths of all PPC Concretes with IWP compound had **lower than 90 percent compressive strength** of concrete without IWP Compound. All PPC Concretes with IWP Compound samples had more or less equal Initial and Final setting times and also IST and FST are **within the IS Limits** when compared to concrete without IWP compound. The OPC and PPC concrete sample with IWP-2 had **more than 50 percent water permeability** when compared to control concrete water permeability. Whereas, the OPC and PPC concrete sample with IWP-1 and EWP had **less than 50 percent water permeability** (with in a limit) when compared to control concrete water permeability.

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