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Experimental Work on Concrete Using Natural Leaf Fibre

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Abstract:- The rising concern about the depletion of resources and environmental pollution has led to the creation of new materials based on renewable resources. Literature studies were conducted to know the mechanical, dynamic properties of leaf fiber added concrete, and it was concluded from this review that fibers are used in concrete to improve their properties The use of natural fibers, rather than synthetic fibers, is highly recommended for environmental protection. The research is carried out using pineapple leaf fiber to test the properties of concrete to enhance the strength characteristic of the structure and economic benefits. PALF constitutes a chemical composition lignin, wax, cellulose and ash content is extracted by two methods as chemical treatment by retarding process and surface treatment using silane material to obtain good binding properties, resulting in an increase in concrete strength behaviour. The experiment is conducted to determine the strength of concrete by incorporating pineapple leaf fibre. Specimens were prepared for each ratio to find compressive, split tensile strength, concrete flexural strength at 7days 14 days and 28 days.

Keywords:- *Natural Leaf fibre , workability, compressive strength, tensile strength, flexural strength.*

I. INTRODUCTION

The growth of infrastructure around the world generated demand for construction materials. Concrete is the primary structural engineering building material. Concrete production includes material intake, aggregates, water and natural leaf fibre. The major part forms among all aggregates. The United States generates two trillion tons of gross per year. By 2020 production is projected to grow to over 3 billion tons in a year. The use of natural fibres in such a scale leads to a contribute the sustainability of natural sources. Additionally, the major sources of environmental issues are the combined manufacturing and processing activities. In the light of this, usage of contemporary civil engineering. Alternate material render concrete as sustainable and environmentally friendly building material, instead of natural fibre in concrete production. Cement, water as well aggregate and addition of some fibres are the important constituents of concrete. In general, aggregates are either classified as the fine (M-sand) or coarse (stone) variety of inert "filler" material. Such fiber addition appears to reflect a relatively high percentage of concrete per volume to reduce material costs. Studies into natural leaf fibre have shown greater potential in use as a material in construction. Use of natural fiber would not only save these building material but also help to solve this waste product's disposal problem. Therefore, to meet the needs of the buildings, The need to add fiber to the current concrete content must be changed. Thus the most economical, ecological enhancement of the structure's work-building facility is essential in the current economy. With modern engineering practices becoming more demanding, Different types of materials with novel properties are needed as necessary. Engineers are constantly looking for materials that can be used as a addition for traditional or that include such properties as allow new thoughts and inventions leading economic growth. Several attempts have been made to develop materials is a combination more than one materials. These substances relatively known as composites. Several attempts were made to develop new materials which are the synthesis of two or more materials. In order to overcome the above backdrops, different waste generated from different activities which includes any material that is made useless during a manufacturing process such as that of factories, mills and mines etc. are used for construction purposes. This has existed since the start of the Industrial Revolution. The industrial sectors which are the origins of eco-friendly nature have been given special attention in recent years.

II. EXPERIMENTAL SETUP

In this point, the collection of the necessary materials and the data needed for mix design is obtained through sieve analysis and precise gravity testing. Sieve analyzes are carried out from various samples of fine aggregates (FA) and coarse aggregates (CA), choosing the sample that fits the requirement. Specific gravity testing is carried out on both fine and coarse aggregates. The different materials that were used were tested according to standard Indian requirements.

A. Materials

Cement, fine aggregate, coarse aggregate, natural fibre, and water are the raw materials required for the actual work's concreting operations.

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B. Cement

The most commonly used cement is an ordinary cement on Portland. Used is the IS compliant 53 grade Ordinary Portland Cement: 12269- 1987. Many cement tests have been carried out; some of them include Specific gravity, test atmosphere, etc.

Tests	Results for tests
Normal consistency of cement	28%
Specific gravity of cement	3.16
Initial setting time of cement	26 minutes
Final setting time of cement	534 minutes

Table 1

C. Aggregates

The aggregates used have a thickness of 20 mm, and the sand grain used is in zone 2. The composite test is performed, and the results are as follows.

- ***Sieve Analysis test:*** The sieve research study is performed to obtain a distribution of the aggregate size of grain. The test was performed on 20 mm aggregates, M sand, for the plant.

- ***Fine Aggregate-M sand*****:** Fine sieve aggregate analysis is carried out to assess the sand's grain size and its location. The analysis is carried out in a manual sieve shaker with 500 grams of air, the sieve dishes being arranged from 10 mm to 150 microns down to sieve shaker order for around 5 minutes. The modulus of fineness obtained from the analysis is 2.46. Good aggregate has a gravity rating of 2.51.

- ***Coarse Aggregate test*****:** The sieve analysis is carried out for the coarse aggregate to find out the aggregate size and its location. Fractions of 75 mm to 4.75 mm are considered coarse aggregates. The crushed Basalt rock coarse aggregates are used according to IS 383-1970. To find out the aggregate size and its location, the sieve analysis is carried out for the coarse aggregate. Fractions of between 75 mm and 4.75 mm are considered coarse aggregates. In compliance with IS 383-1970, the coarse aggregates from broken basalt rock are used.

D. Water Absorption Test

The sieve analysis is performed for coarse aggregate to determine the aggregate size and position. The fractions of 75mm to 4.75 mm are called coarse aggregates. The Coarse Aggregates from crushed Basalt rock are used, in accordance with IS 383 – 1970. Weight changes are obvious. The water absorption cap value is 2%, according to the code. Results for the aggregates measured are 1% for sand and 0.5% for 20 mm aggregates

III. METHODOLOGY

Cubes and cylinders have been prepared for every test performed. Cubes and cylinders were equipped to obtain the compressive strength and the tensile splitting force respectively. The samples were casted 28 days and cured. The cured specimens were examined for 28 days, and the results were gathered. The dimension cube 150 mm on all sides is subjected to a large compressive force magnitude near the loading areaThe compressive intensity was calculated using the normal formulation of stress P / A, with P being the ultimate load in KN, and A being the area in m^2. The split tensile strength was performed by the specimen of the 150mm radius and 300 mm height cylinder and was determined using the expression $ft = 2P / \pi LD$ where P is the ultimate load in KN, L is the cylinder depth in m and D is the cylinder diameter in m.

IV. RESULTS AND DISCUSSION

A. Slump Test on fresh concrete

The slump test is used to assess the practicability of fresh concrete. The device used to do the slump test was the slump cone and the tamping rod. Before the test started, the inner surface of the mould was thoroughly cleaned and released from superfluous humidity and adherence to any old concrete set. The mould was then filled into four layers, each 1/3 of the mould 's height, each being tampered with a tamping rod.

Conventional concrete slump value - 25 mm
1% addition of fibres - 24.5 mm
1.5% addition of fibres - 24 mm
2% addition of fibres - 22 mm

The aforementioned slump value in accordance with IS code 456 is within the permissible limit and is suitable for construction purposes and has good operability.

B. Compaction Factor Test for workability

To test the workability of fresh concrete, the compacting factor of fresh concrete is accomplished by compacting factor check as per IS 1199-1959. This test provides concrete actions when external forces intervene. When you measure the compact power of the concrete, by calculating the amount of compaction. This test is ideal for medium- and low-workability blends, i.e. compaction factor between 0.90 and 0.80, but the compaction factor below 0.71 is not appropriate for very low-workability concretes. Commercially available, the tool consists of a rigid frame, mounted over a cylinder, supporting two vertically aligned conical hoppers. The top hopper is considerably bigger than the bottom hopper, while the container diameter is smaller than the two hopper.

C. Compressive Strength of Concrete

This test is performed in order to assess the cube strength of the concrete mix being prepared. The test is conducted on the 7th and 28th day, and its observation is defined as a graph below. Levels of compressive strength of fiber inclusion at 1%, 1.5 % and 2%

Type of Mix	Average compressive strength (N/mm^2)		
	7day	14day	28 day
NC	15.5	19.55	23.1
1% NF	17.3	20.	24.5
1.5% NF	18.1	22.2	25.2
2% NF	19.1	22.6	26.66

Table 2:- Compressive Strength Results

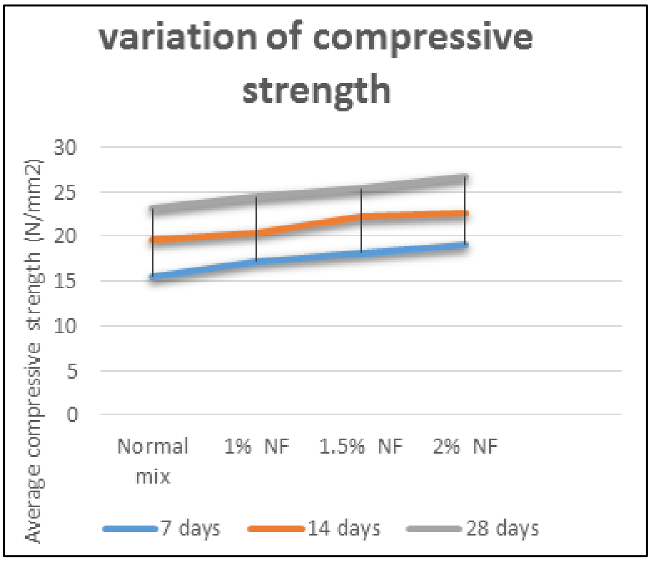

Fig 1:- compressive Strength variation

D. Tensile strength of concrete

This test is conducted for evaluating the tensile strength of the cylinders. The test is conducted on the 7th and 28th day, and its observation is defined in a graph below. The cylinder is positioned horizontally and the load is applied slowly, and the value is registered if the cylinder is divided into two halves or if the cylinder fails when the load is applied. Values of tensile strength with addition of 1%, 1.5 % and 2%

Type of Mix	Average tensile strength (N/mm^2)		
	7day	14day	28 day
NC	1.50	1.93	2.55
1% NF	1.70	2.05	2.60
1.5% NF	1.80	2.45	2.7
2% NF	1.9	2.85	3.15

Table 3:- Tensile Strength of concrete

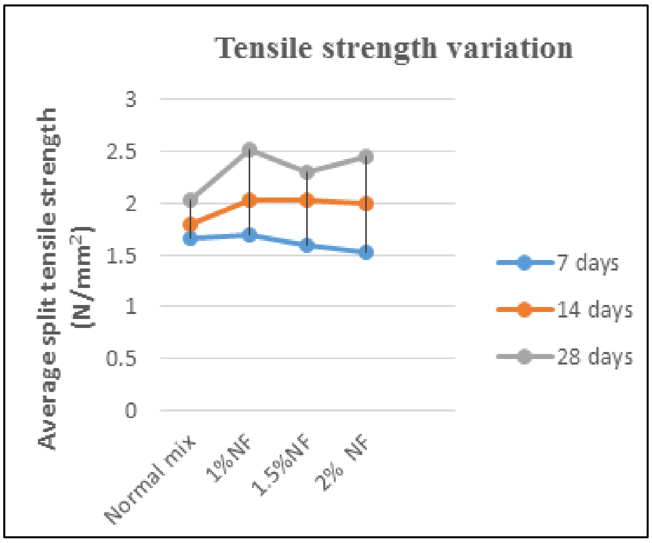

Fig 2:- Tensile Strength of Concrete variation

E. Flexural Strength of Prism:

Flexural resistance is a beam or slab force for survival of bending failure. This is calculated by loading the depth of unreinforced concrete beams with a length of 500 mm span, width and depth of 100 mm three times. In N / mm2 the flexural resistance is expressed as "Modulus of Rupture" (MR). The flexural element of Rupture is about 12 to 20 per cent compressive strength Then laboratory studies achieve the strongest association with different materials. The specimens undergo external cure are checked after the 28 days. The rupture modulus is determined as follows

$$R = PL/bd^2$$

Where,
L = length in of span
b = width of prism
d = depth of prism

Type of Mix	Average tensile strength (N/mm²)		
	7day	14day	28 day
NC	1.4	1.8	2.03
1% NF	1.53	1.96	2.22
1.5% NF	1.6	2.03	2.3
2% NF	1.7	2.05	2.45

Table 4:- Flexural strength of Prism

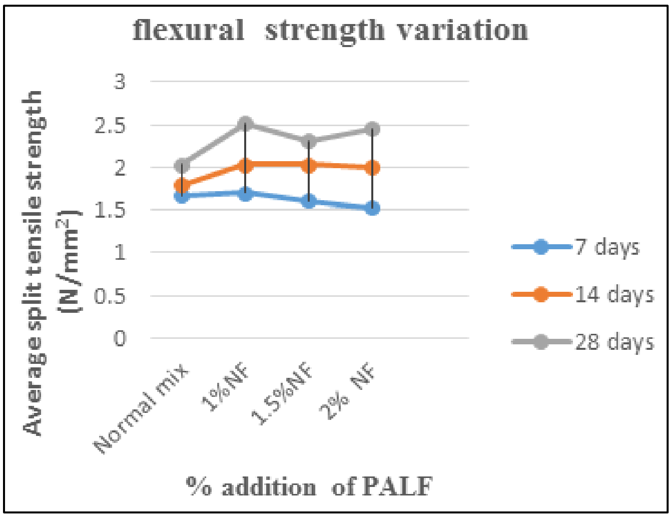

Fig 3:- Flexural Strength of Concrete Variation

V. CONCLUSION

- The test results show that the concrete strength is slowly increased by the inclusion of leaf fibers in concrete by various ratios
- The compressive strength test result of NF1, NF2, NF3 specimen shows that strength of concrete is increased When compared with concrete(CC) regulated.
- The NF1, NF2, NF3 specimen 's split tensile strength is also higher when compared to concrete control.
- In contrast with control concrete, the flexural strength of the NF1, NF2, NF3 specimen also increases.
- In order to increase strength were fibre of natural leaf can be added to particular percentage in concrete

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