

# Experimental Study on the Strength Properties of Natural Resin Concrete Using Jute Fibre

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**ABSTRACT:** Concrete is today the largest consumable material in the world that utilizes the natural resources such as sand, crushed stone and water. Due to the depletion of these natural resources for concreting, research is being carried out now a days to reduce the consumption of these resources. In our project, we tend to use natural resin aloe vera , a plant derived resin used as an admixture in casting of concrete along with the jute fibre to enhance its strength properties. The concrete is cast in cubes and cylinders and it is tested for compressive strength and tensile strength to find the optimum percentage of their replacement.

**KEYWORDS:** aloe vera , jute fibre...etc

## I INTRODUCTION

Concrete is one of the most widely used construction material. The properties of concrete such as strength setting time etc. can be modified by adding any additives, chemical admixtures, polymers and fibres. In this project, we tend to use a natural resin in concrete along with a fibre and study the properties of concrete due to addition of resin and fibre .Buildings are a major source of CO<sub>2</sub>.which are emitted throughout the entire life span of the building Crop derived materials have performance attributes that can improve the —in-use energy profile of buildings as well as inherently low embodied energy. Many construction materials, such as concrete or fired bricks and concrete blocks, use large amounts of energy in their production and transport .To minimize this energy plant derived products are utilized in our project further their strength and other properties are compared with conventional concrete.

## II OBJECTIVE OF THE PROJECT

- To choose a natural resin based on its physical and chemical composition to use in concrete.
- To study compressive, tensile and flexural behaviour of resin fibre concrete.
- To compare the results with that of conventional concrete specimen.

## III GENERAL

The widespread use of agricultural crops would greatly reduce the impact of construction material use. In addition, any waste from agricultural crops can normally be disposed of safely and easily, with little or no environmental damage. Hence our project aim is to use natural resin and jute fibre combined to provide a substantial environmental benefit to use of crop –based materials and efficient use of construction material. Most of embodied energy is produced by the burning of fossil fuels, which increases the amount of carbon dioxide (CO<sub>2</sub>) in the atmosphere, causing the temperature of the earth to rise which is linked to climate change. By use of plant derived products in construction may reduce the emission of these embodied energy and at the same time strength of these concrete is also maintained by use jute fibre which is added at the proportion of 1% to the weight of cement. Jute is low cost eco-friendly product and is abundantly available easy to transport and has moisture

## International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 7, Special Issue 5, April 2018

1<sup>st</sup> International Conference on Recent Innovation in Civil Engineering and Management (ICRICEM '18)

22<sup>nd</sup> March 2018

Organized by

Department of Civil Engineering & MBA, Loyola Institute of Technology, Chennai, Tamilnadu, India

retention capacity and natural resin is easily available in the environment , moreover use of these products may prevent the plant from depletion of their specis.

### IV. MATERIAL PROPERTIES

- Cement: 53 Grade ordinary Portland cement is used in the present investigation. The properties of cement are determined as per the IS 4031: 1968
- Fine aggregate: Locally available river sand conforming to Grading zone 2 of IS: 383-1970.
- Natural resin (15 % to the weight of cement ) and jute fibre (1 % to the weight of cement ) are added as admixture.

#### MATERIALS USED

- Cement
- Aggregate
- Jute fiber
- Natural resin

#### CEMENT

Cement is a binder, a substance used in construction that sets and hardens and can bind other materials together. The most important types of cement are used as a component in the production of mortar in masonry, and of concrete, which is a combination of cement and an aggregate to form a strong building material.

#### FINE AGGREGATE

Aggregates are inert granular materials such as sand, gravel, or crushed stone that, along with water and Portland cement, are an essential ingredient in concrete.

Aggregates strongly influence concrete's freshly mixed and hardened properties, mixture proportions, and economy. Consequently, selection of aggregates is an important process. Although some variation in aggregate properties is expected, characteristics that are considered include:

- grading
- durability
- particle shape and surface texture
- abrasion and skid resistance
- unit weights and voids
- absorption and surface moisture

#### COARSE AGGREGATE

It is the aggregate most of which is retained on 4.75 mm IS sieve and contains only so much finer material as is permitted by specification. According to source, coarse aggregate may be described as:

- Uncrushed Gravel or Stone– it results from natural disintegration of rock
- Crushed Gravel or Stone– it results from crushing of gravel or hard stone.

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- Partially Crushed Gravel or Stone– it is a product of the blending of the above two aggregate.

According to size coarse aggregate is described as graded aggregate of its nominal size i.e. 40 mm, 20 mm, 16 mm and 12.5 mm etc. for example a graded aggregate of nominal size 20 mm means an aggregate most of which passes 20 mm IS sieve.

**WATER**

The strength of cement concrete depends mainly from the binding action of the hydrated cement paste gel. A higher water-binder (w/b) ratio will decrease the strength, durability, water-tightness and other related properties of the concrete. As per Neville (2000), the quantity of water added should be the excess water would end up only in the formation of undesirable voids (capillary pores) in the hardened cement paste of concrete. The strength of cement paste is inversely proportional to the dilution of the paste. Hence, it is essential to use as little paste as possible, consistent with the requirements of workability and chemical combination with cement. Potable water is used for concreting.

**JUTE FIBRE**

The fibres are extracted from the ribbon of the stem. When harvested the plants are cut near the ground with a sickle shaped knife. The small fibres, 5 mm, are obtained by successively retting in water beating, stripping the fibre from the core and drying. Due to its short fibre length, jute is the weakest stem fibre, although it withstands rotting very easily. It is used as packaging material (bags), carpet backing, ropes, yarns and wall decoration.

**PROPERTIES OF JUTE FIBER**

- Jute fibre is 100% bio-degradable and recyclable thus environmental friendly.
- Jute is a natural fibre with golden and silky shine, hence called The Golden Fibre.
- Jute is the cheapest vegetable fibre procured from the bast or skin of the plant's stem.
- It is the second most important vegetable fibre after cotton, in terms of usage, global consumption, production and availability.

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Property	Jute
Density [g/cm <sup>3</sup> ]	1.46
Tensile strength [N/mm <sup>2</sup> ]	400-800
Stiffness [KN/mm <sup>2</sup> ]	10-30
Elongation at break [%]	1.8
Moist absorption [%]	12
Price of raw fibre [\$/kg]	0.35
Price of raw fibre [Rs/kg]	20

**NATURAL RESIN**

Aloe vera resin is dumped in water for a certain period. This resin water is used for concreting.



**V. ADVANTAGES OF JUTE FIBRE**

- Reinforcement makes cement compositions stronger and more resistant to cracks.
- The addition of jute fibers also delays the hardening of concrete and mortar, which must be trucked to construction sites.
- The jute fibre is more economical and easily available.
- It posses low thermal conductivity.
- Moisture regain properties of jute is good enough.

**VI. ADVANTAGES OF NATURAL RESIN**

- It is abundantly available in the environment .
- The second is that it is soluble in alcohol and related compounds, but not in water.
- This is what makes resins so useful; they can be heated or processed in alcohol to soften them, applied to something, and allowed to dry. Once dry, the resin will not admit water intrusion.

### VII. MIX DESIGN

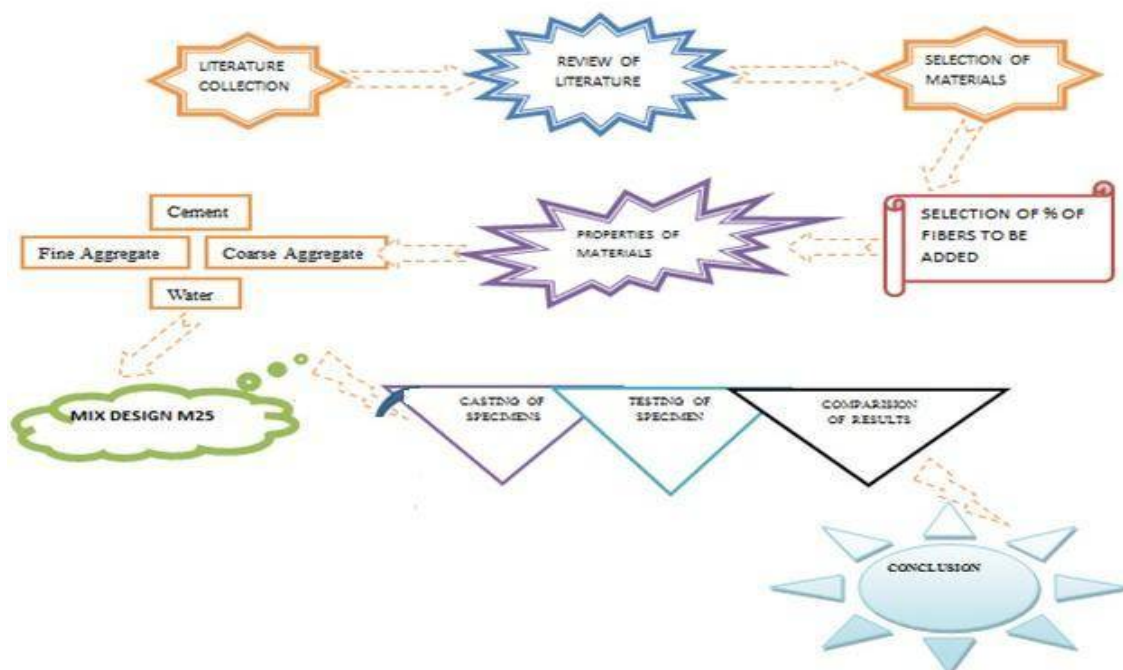
The concrete mix for the manufactured sand is done as per IS 10262-2009. The detailed concrete mix design concrete designing is done. Summary of quantity of materials adopted for different parameters of M25 Grade concrete.

The mix proportion is as follows:

Water	Cement	Fine Aggregate	Coarse Aggregate
197.16	438.133	835.43	1157.649
<b>0.45</b>	<b>1.00</b>	<b>1.906</b>	<b>2.64</b>

### VIII. EXPERIMENTAL METHODOLOGY

Initially the materials used in concrete are tested for its basic properties. Then the mix design is carried out according to the codal provisions. In the obtained mix proportions natural resin and jute fibre are added as admixture in the varying proportions of jute fibre are 0.5,1,1.5,2,2.5 respectively. The concrete specimens are casted for the above mix proportions and cured in potable water till the date of testing. Then the specimens are tested for cube compressive test and cylinder is tested for split tensile test.



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### IX. TESTS ON CONCRETE

To evaluate the strength properties of mix properties used in this project , the following tests were performed.

- Compressive strength
- Split tensile strength
- Flexural strength test

#### COMPRESSIVE STRENGTH TEST

The specimen were removed from chamber after 24 hours, de moulded carefully and were kept in ambient conditions. Testing was done after 3 days, 7 days, 14 days and 28 days of ambient curing. The bearing surface of the testing machine was cleaned. The specimen was placed in 2000KN capacity compression testing machine in such a manner that the load could be applied to the opposite sides of the cube. The specimen was aligned centrally on the base plate of the machine. The movable portion was rotated gently by hand that, it touched the top surface of the specimen. The load was applied gradually without shock and continuously at the rate of 140Kg/cm<sup>2</sup>/minute till the specimen failed. The maximum load at which the specimen failed was recorded.



#### SPLIT TENSILE STRENGTH

Concrete being a brittle material is not expected to resist direct tensile forces. However tensile strength is of important with regards to cracking, due to tensile failure. Some researchers have observed that the type of coarse aggregate has a relative effect on tensile strength that on compressive strength. Generally for quality control concrete tensile strength is never made.



#### FLEXURAL STRENGTH OF PRISM

Beam flexural strength tests will be carried out on beam specimen of 700\*150\*150mm at the age of 28 days curing and without curing using compression testing machine of 200KN capacity.



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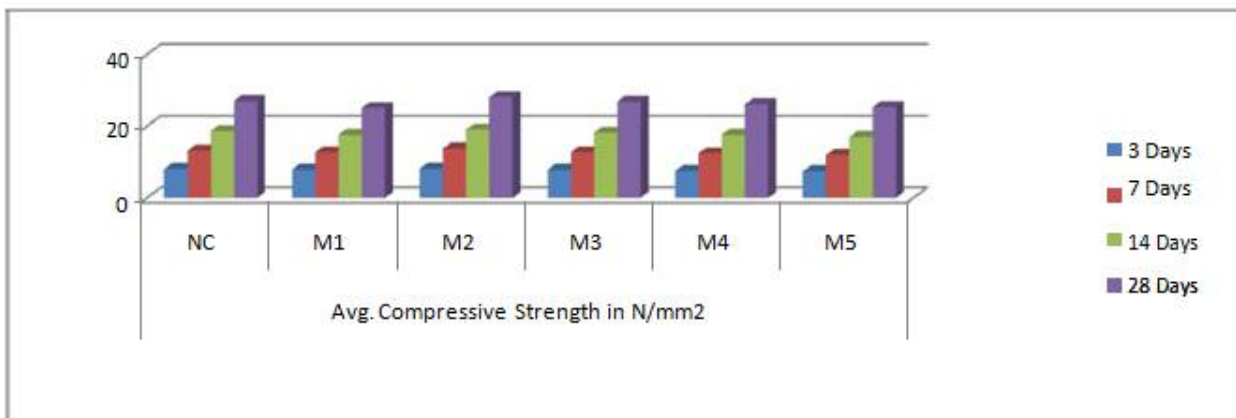


**X. RESULTS AND DISCUSSION**

**1) COMPRESSIVE STRENGTH OF CONCRETE**

The compressive strength, split tensile strength and flexural strength of concrete increases in all age of concrete in addition of natural resin and jute fibre.

S. NO.	Age of concrete	Avg. Compressive Strength in N/mm <sup>2</sup>					
		NC	M1	M2	M3	M4	M5
1	3 Days	8.09	7.89	8.12	7.86	7.52	7.43
2	7 Days	13.17	12.68	13.75	12.72	12.41	11.98
3	14 Days	18.58	17.52	19.02	18.05	17.55	16.97
4	28 Days	27.02	25.03	28.09	26.79	26.11	25.32



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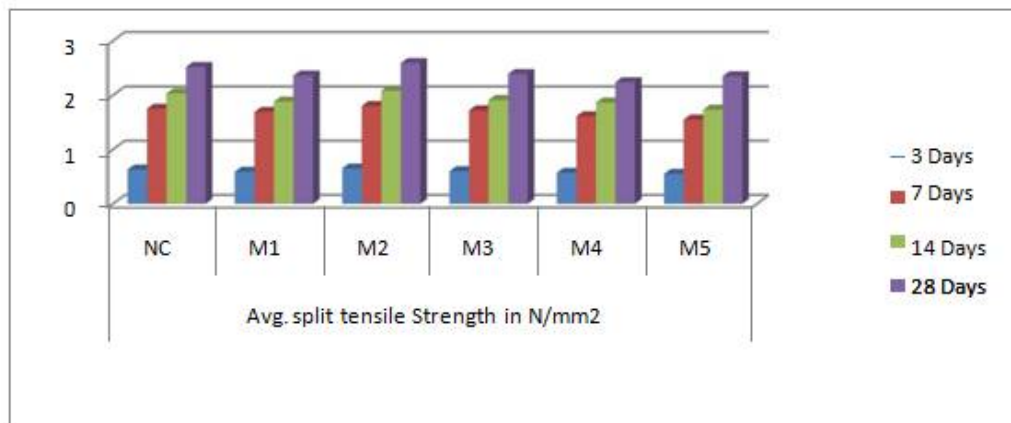
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**2) SPLIT TENSILE STRENGTH OF CONCRETE**

S. NO.	Age of concrete	Avg. split tensile Strength in N/mm <sup>2</sup>					
		NC	M1	M2	M3	M4	M5
1	3 Days	0.63	0.59	0.65	0.60	0.57	0.55
2	7 Days	1.75	1.69	1.80	1.72	1.61	1.55
3	14 Days	2.03	1.88	2.08	1.91	1.86	1.73
4	28 Days	2.52	2.36	2.59	2.39	2.24	2.35



**XI. CONCLUSION**

- In all age of concrete, the strength of concrete is more for M2 mix of concrete.
- The compressive strength of M2 mix concrete is greater than the conventional curing concrete at 28 days.
- The split tensile strength of M2 mix concrete is greater than the conventional curing concrete at 28 days.
- Thus, in all age of concrete, the strength of concrete is more when aloe vera resin and 1% jute fibre is used.

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