International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 05, May-2019

EXPERIMENTAL ANAYLSIS ON STRENGTH PROPERTIES OF CONCRETE BY USING ALOEVERA AND JUITE FIBER

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Abstract— Concrete is today the largest consumable material in the world that utilizes the natural resources such as fine aggregate, crushed stone and water. Concrete is a very strong and versatile mouldable construction material having vital advantages such as low cost, general availability and wide usage. Due to the depletion of these natural resources for concreting, research is being carried out now a day to reduce the consumption of these resources. In our project we tend to use a plant derived resin called Aloe Vera as an admixture in casting of concrete. In addition to Aloe Vera, Jute fiber is being used here to enhance the strength properties of concrete. The concrete is cast in cubes and cylinders and it is tested for compressive strength, tensile strength to find the optimum percentage of their replacement. 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.

Keywords— Cement,coarse aggregate, fine aggregateAloe Vera, Jute fiber.

I. INTRODUCTION

Concrete's versatility, durability, sustainability, and economy have made it the world's most widely used construction material. About four tons of concrete are produced per person per year worldwide and about 1.7 tons per person in the United States. The term concrete refers to a mixture of aggregates, usually sand, and either gravel or crushed stone, held together by a binder of cementitious paste.

Concrete made with Portland cement has certain characteristics; it is strong in compression but weak in tension and tends to be brittle. The weakness in tension can be overcome to some extent by the inclusion of a sufficient volume of certain fibres. The use of fibres also alters the behaviour of the fibre matrix composite after it has cracked, thereby improving its toughness. The concept of using fibres to improve the characteristics of construction materials is very old. When concrete cracks, and randomly oriented fibres start functioning, arrest cracks formation and propagation, and thus improve strength and ductility. As India is one of the largest producers of jute, hence its potential application in many branches of engineering should be developed.Natural fibres are emerging as low cost, light weight and apparently environmentally superior alternatives to glass fibres in composites. Reasons to go for natural fibre composites is natural fibre production has lower environmental impacts compared to glass fibre production.

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 (CO2) 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 of jute fibre, aloevera which are added in the proportion of 0.5%,1%,1.5%,2% to the weight of cement and quantity of water. Jute is low cost eco-friendly product and is abundantly available, easy to transport. The objective of this research is to experiment on the use of jute fibres and natural resin as an enhancement of concrete. From our project we had seen that there is considerable increase in strength of concrete by adding Jute and Aloe Vera in concrete.

B.Muhu Malini et.al. (2018) In this research paper 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. the strength of concrete is more when aloe vera resin and 1% jute fibre is used.

II.EXPERIMENTATION & METHODLOGY

Materials:

1.CEMENT:

Cement can be defined as bonding material having cohesive and adhesive properties which makes it capable to unite different construction materials and form the compacted assembly.Ordinary Portland cement is one of the most widely used type of Portland cement. The raw materials used in the manufacture of opc are silicates of alumina in the form of

clays and shales, calcium carbonate in the form of limestone, chalk and marl which is a mixture of clay and calcium carbonate.

Properties of cement:
The ordinary Portland cement which conforms to IS 12269 – 1987 was used for making concrete. The physical properties of cement which was used for the experimental investigations are given in Table 1 and the chemical composition of cement is given in Table 2.




Fig. No 1: Cement **Fig. No2: Fine aggregate** **Fig. No 3: Coarse Aggregate** **Fig. No 4: Jute fibre**

2. FINE AGGREGATE:
The Particles almost entirely passing the 4.75 mm sieve and predominantly retained on 75 micron sieve are called Fine Aggregate.

3. COARSE AGGREGATE:
The Particles which predominantly retain on 4.75mm sieve and which pass through a 3- inch screen are called Coarse Aggregates. The coarser the aggregate, the more economical the mix. The size of coarse aggregate used in our study was 20 mm sieve pass and 12.75 mm sieve retain.

Requirements of Good Aggregate:
It should be Strong enough, It should be durable and It should have rough surface.

4. JUTE FIBRE:
Jute is a natural fibre with golden and silky shine, hence it is called as THE GOLDEN FIBRE. Jute with the highest production volume is the cheapest natural fibres. These fibres are extracted from the ribbon of stem. These fibres are composed mainly of cellulose and lignin i.e., plant materials. It is 100% bio degradable and recyclable thus environmental-friendly. Recent studies have shown that jute fibre improves the resistance of concrete against cracking and also delays the hardening of concrete.

PROPERTIES OF JUTE FIBRE:
It is easily available and Low cost eco-friendly product. Jute fibers can be used in order to overcome the brittle behavior of concrete the common structural property of jute fibers is that they provide high tensile strength. The content of jute fiber is determined with respect to the weight of the cement. Addition of jute fibers, predominantly increase the compressive strength of concrete.

PROPERTY	JUTE	Chemical composite	Percentage
Density (g/cm3)	1.46	Cellulose	65.2%
Tensile Strength (N/mm2)	400-800	Hem Cellulose	22.2%
Stiffness (KN/mm2)	10-30	Lignin	10.8%
Elongation at break (%)	1.8	Water	1.5%
Moist Absorption (%)	12	Fats and Wax	0.3%

Table No 1: Properties of Jute Fibre & *Composition of Jute fibre*

5. ALOEVERA:
AloeVera is a succulent plant species of the genus Aloe. An evergreen perennial, it originates from the Arabian Peninsula but grows wild in tropical climates around the world. Aloe Vera is a thick, short-stemmed plant that stores water in its leaves. Aloe Vera is well recognized by its thick, pointed and fleshy green leaves, which can grow to about 12-19 inches (30-50 cm) in length. Each leaf is full of a slimy tissue that stores water, which makes the leaves thick. This slimy, water filled tissue is called as “Gel”.

Fig. No 5: Aloe Vera

PROPERTIES OF ALOEVERA:

The properties of aloevera are as follows

It helps in the improvement of compressive strength and flexural strength, it increases the setting and hardening time of concrete, it helps in the reduction of cracks in the concrete.

WORKABILITY:

Workability of concrete is defined as the ease and homogeneity with which a freshly mixed concrete or mortar can be mixed, placed, compacted and finished. Strictly, it is the amount of useful internal work necessary to produce 100% compaction. The workability of all concrete mixes was found by the following two tests.

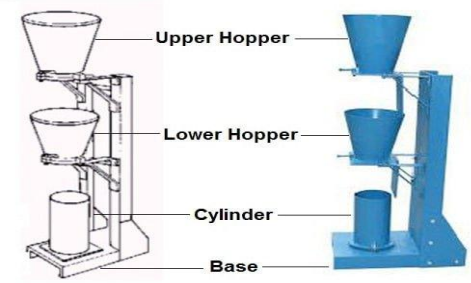
SLUMP CONE TEST:

Slump Test: Slump test is the most commonly used method of measuring consistency of concrete which can be employed either in laboratory or at site of work. It is not a suitable method for very wet or very dry concrete. It does not measure all factors contributing to workability, nor is it always representative of the placability of the concrete.

The slump of concrete = 10 cm

COMPACTING FACTOR TEST:

Compaction factor test is the workability test for concrete conducted in laboratory. The compaction factor is the ratio of weights of partially compacted to fully compacted concrete. It was developed by Road Research Laboratory in United Kingdom and is used to determine the workability of concrete.The compaction factor test is used for concrete which have low workability for which slump test is not suitable.



Compaction Factor Test on Concrete

The Compaction factor values ranges from 0.7 to 0.95**.**

Weight of partially compacted concrete, W1 = 18.26 kgs

Weight of fully compacted concrete, W2 = 19.70 kgs

Compaction factor = W1/W2 = 18.26/19.70 = 0.92

Hence the compaction factor obtained is **0.92**

CASTING OF SPECIMENS:

Table No:2 Specimen details of the project

Sl.No	Nomenclature	No of cube Specimens	No of cylinder Specimens
1	Type-1	8	8
2	Type-2	8	8
3	Type-3	8	8
4	Type-4	8	8
5	Type-5	8	8

Fig: Cube Casting

Fig: Cylinder Casting

Fig: Curing of specimens

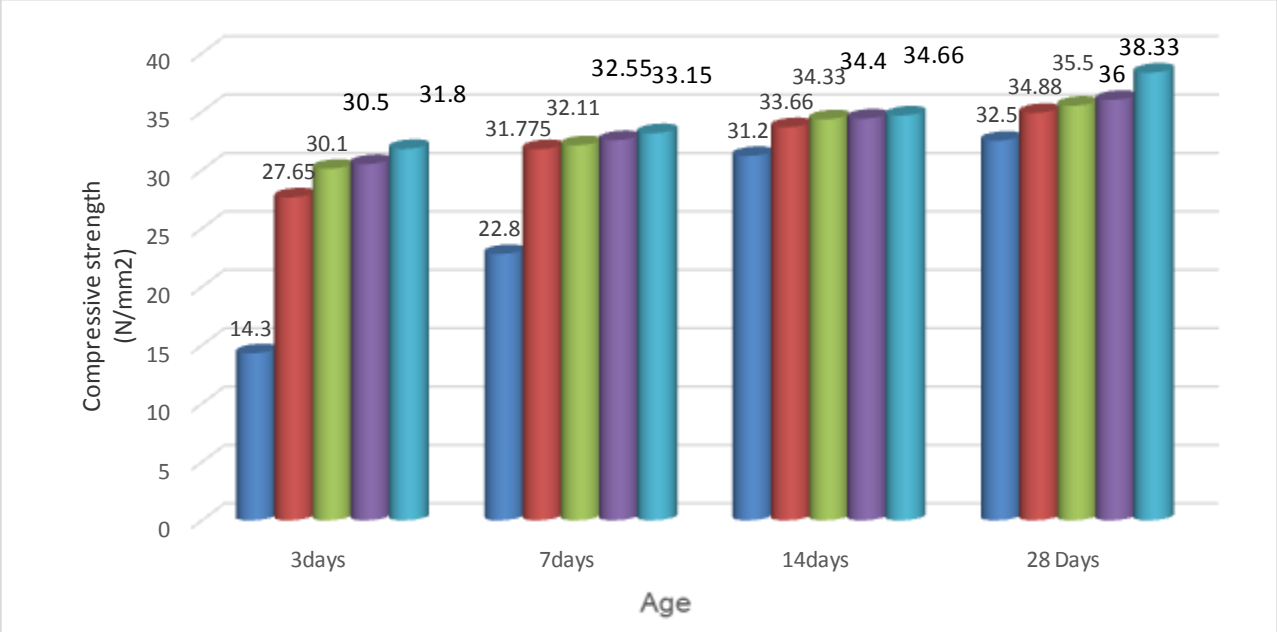
TESTS AND RESULTS :

RESULTS AND DISCUSSION

Table No: 3 COMPRESSION STRENGTH ON CUBES 3, 7, 14, 28 days

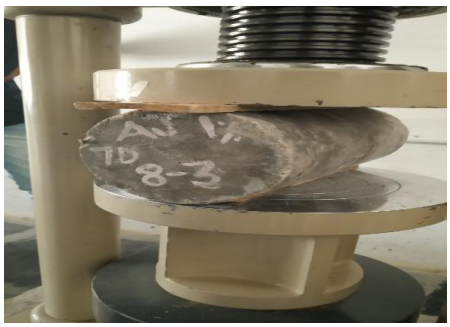
Type	Admixtures	Compressive Strength (N/mm2)	Compressive Strength (N/mm2	Compressive Strength (N/mm2	Compressive Strength (N/mm2
Type-1	Normal Concrete without the addition of any admixtures	14.3	22.8	31.2	32.5
Type-2	Addition of 0.5% of AloeVera and Jute Fibre to the concrete	27.65	31.775	33.66	34.88
Type-3	Addition of 1% of AloeVera and Jute fibre to the concrete	30.10	32.11	34.33	35.5
Type-4	Addition of 1.5% of AloeVera and Jute fibre to the concrete	30.5	32.55	34.4	36
Type-5	Addition of 2% of AloeVera and Jute fibre to the concrete	31.8	33.15	34.66	38.33

Graph No :1 Compressive Strength Variation



SPLIT TENSILE STRENGTH ON CYLINDER

Split Tensile Strength test is carried out on specimen cylinders of concrete blended with various percent addition of Aloe Vera and Jute fibre to the cement, fine aggregate, coarse aggregate(varying percentages i.e., 0.5%,1%,1.5%,2%) and on specimen cylindesrs of conventional concrete at 3,7,14 and 28 days of curing with compression testing machine.

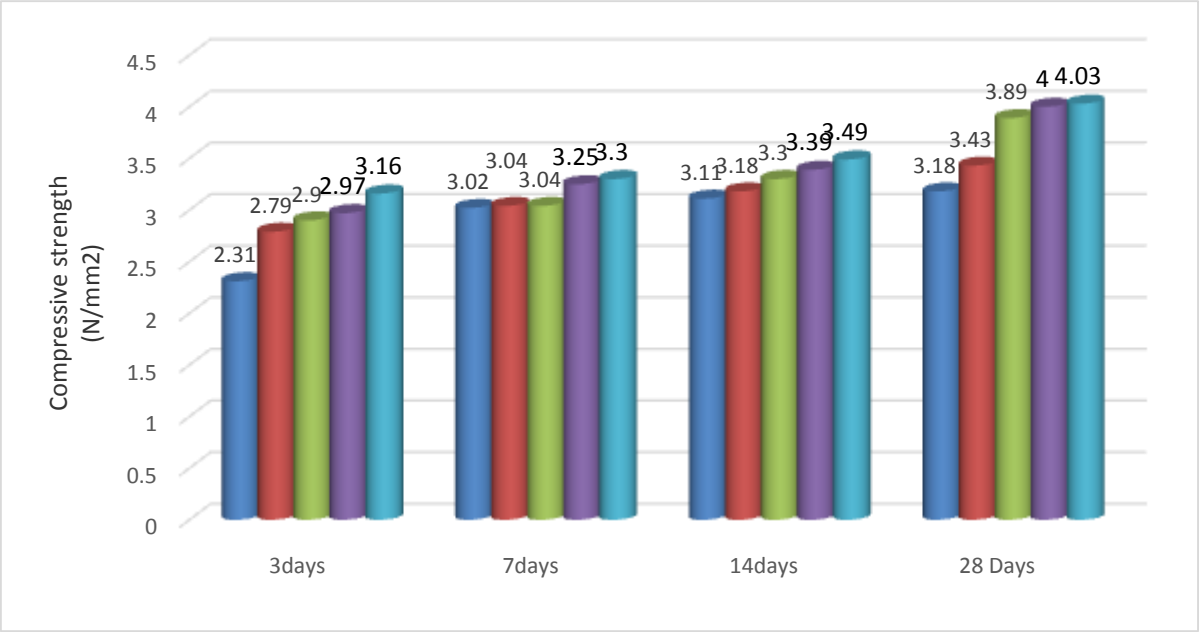


Tensile Strength Variation

Table No: 4

Type	Admixtures	3 Days	7 Days	14 Days	28 Days
Type-1	Normal cylinders without the addition of any admixtures	**2.31**	**3.02**	**3.11**	**3.18**
Type-2	Addition of 0.5% of AloeVera and Jute fibre to the concrete cylinders	**2.79**	**3.04**	**3.18**	**3.43**
Type-3	Addition of 1% of AloeVera and Jute fibre to the concrete cylinders	**2.9**	**3.04**	**3.3**	**3.89**
Type-4	Addition of 1.5% of AloeVera and Jute fibre to the concrete cylinders	**2.97**	**3.25**	**3.39**	**4**
Type-5	Addition of 2% of AloeVera and Jute fibre to the concrete cylinders	**3.16**	**3.3**	**3.49**	**4.03**

Graph No: 2



CONCLUSION:

In our project we tend to use a plant derived resin called Aloe Vera as an admixture in casting of concrete. In addition to Aloe Vera, Jute fiber was used here to enhance the strength properties of concrete. The concrete is cast in cubes and cylinders and it is tested for compressive strength, tensile strength to find the optimum percentage of their replacement.
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
Aloe Vera and Jute fibre are added as admixtures. The following conclusions are arrived from the basis of conducting experimental investigations

1.The workability of Concrete when Aloe Vera and jute fibre used as admixtures in concrete, was more when compared to ordinary concrete.
2.Addition of Aloe Vera and Jute fibre increased the Compressive Strength and Tensile Strength of concrete compared to the conventional concrete.
3.The content of jute fibre is determined with respect to the weight of the cement.
4.Aloe Vera increases the setting and hardening time of concrete.
5.It helps in the reduction of cracks in the concrete.
6.The study has shown that Jute fibre delays the hardening of concrete and improves the resistance of concrete against cracking.
7.But increase in fibre proportion beyond a certain limit leads to decrease in compressive strength and tensile strength of concrete.
8.Due to increase in fibre proportion the water absorption increases which leads to increase in porosity thereby decreasing the strength characteristics.
9.Thus, it is hereby concluded that in all ages of concrete, the strength of concrete is more when 2% of aloevera resin and 2% jute fibre are used

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