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Experimental Study of Aloe Vera in Concrete

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Abstract
Concrete is an innovative material most widely used construction material. It has vital advantages, such as low cost, general availability and wide usage. But this affects environment. Concrete made with Portland cement with certain characteristics it is relatively strong in compression and but weak in tension. Tension weakness can be overcome by the use of conventional reinforcement and to some extent by the inclusion of the sufficient volume of certain fibers. The aim of this work is to find a non-conventional concrete system and it should easily available, accessible, strength enough and also cheap.
Keywords: *Aloe Vera, Strength, Workability, Admixture.*

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I. Introduction

Most damaging is the enormous amount of energy required to produce Portland cement as well as the large amount of carbon dioxide released in the ambience. The non-conventional concrete means adding or replacing some waste materials or fibers in the normal concrete is called non-conventional concrete. We have been conceived with an objective of determining a new non-conventional concrete which should be with easily available and accessible materials presented in this concrete system.

A composite material is made up of two or more constituent materials. The constituent materials differ in their physical and chemical composition. Aloe Vera fibers are environmentally friendly and present important attributes. This kind of waste has a greater chance of being utilized for different applications in construction and building materials. This focused on the use of aloe Vera gel and its effect on the compressive and workability of concrete.

II. Materials

2.1 Cement

Cement is the most important constituent of concrete, which helps to bind and make the concrete to attain its maximum design strength. Ordinary Portland cement is the most commonly used cement for general engineering works. The specific gravity of all grades namely 33,43 and 53 grades. For our study program in concrete, the cement that is used is OPC 53 grade and tests are made to confirm its workability.

Fig 2.1 OPC 53 Grade Cement

2.2 Fine aggregate

Manufactured sand is an alternative for river sand. Due to the fast growing construction industry, the demand for sand has increased tremendously, causing deficiency of suitable river sand in most parts of the world. Due to the depletion of good quality river sand for the use of construction, the use of manufactured sand has been increased. Another reason for the use of M-Sand is its availability and transportation cost. The other advantage of using M-Sand is, it can be dust free, the sizes of m-sand can be controlled easily so that it meets the required grading for the given construction. Fine aggregate conforming to IS 383-1970 is used. The water absorption value was found to be 1.63%.

Fig 2.2 M-sand

2.3 Coarse aggregate

Coarse aggregate is stone which are broken into small sizes and irregular in shape. In construction work the aggregate are used such as limestone and granite or river aggregate. Aggregate which has a size bigger than 4.75 mm or which retrained on 4.75 mm IS Sieve are known as coarse aggregate. The coarse aggregate has a major effect on concrete properties such as abrasion resistance, hardness, elastic modulus, and another characteristic like durability, strong, and cheaper. For coarse aggregate crushed 20mm, normal size graded aggregate was used. The specific gravity and water absorption were found to be 2.85 and 1.0% respectively. The grading of aggregate conformed to the requirement as per IS: 383- 1970.

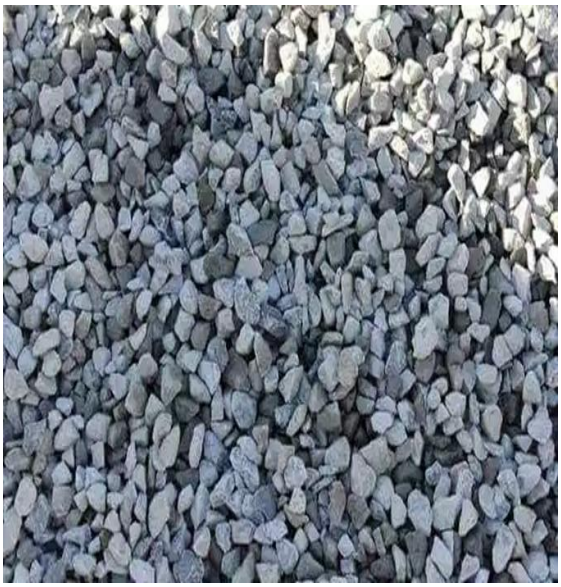

Fig 2.3 Coarse Aggregate

2.4 Water

Water acts as a mixing ingredient between fine aggregate and coarse aggregate to initialize the hydration process for better binding to attain maximum strength and durability. Water is used for curing the concrete after it has cast into the forms of desirable specimens. Water used for both mixing and curing should be free from injurious amounts of deleterious materials (heavy metals lead and lead containing materials etc.). Portable water is generally considered satisfactory for mixing and curing of concrete. If water contains any sugar or an excess of acid or salt, it should not be used. Ordinary tap water can also be used for preparation of concrete.

2.5 Aloe Vera gel

The three structural components of the Aloe Vera pulp are the cell walls, the degenerated organelles and the viscous liquid contained within the cells. The raw pulp of Aloe Vera contains approximately 98.5% water, while the mucilage or gel consists of about 99.5% water.

Table 2.1: Chemical composition Of Aloe Vera Gel

S.NO	Particulars	Proportion
1	Moisture	96.51%
2	Total solids	3.69%
3	Na mg/100g	49.62%
4	K mg/100g	127.4%
5	Mg mg/100g	20.74%
6	Ca mg/100g	71.46%
7	Cu mg/100g	0.034%

Fig 2.4 Aloe vera plant

III. 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 M35 Grade concrete of ratio 1:1.6:2.9.

IV. 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 Aloe Vera juice is added as admixture in varying proportions of 0.5%, 0.7% and 1% of cement weight respectively. Slump cone test is carried out for every mixes 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

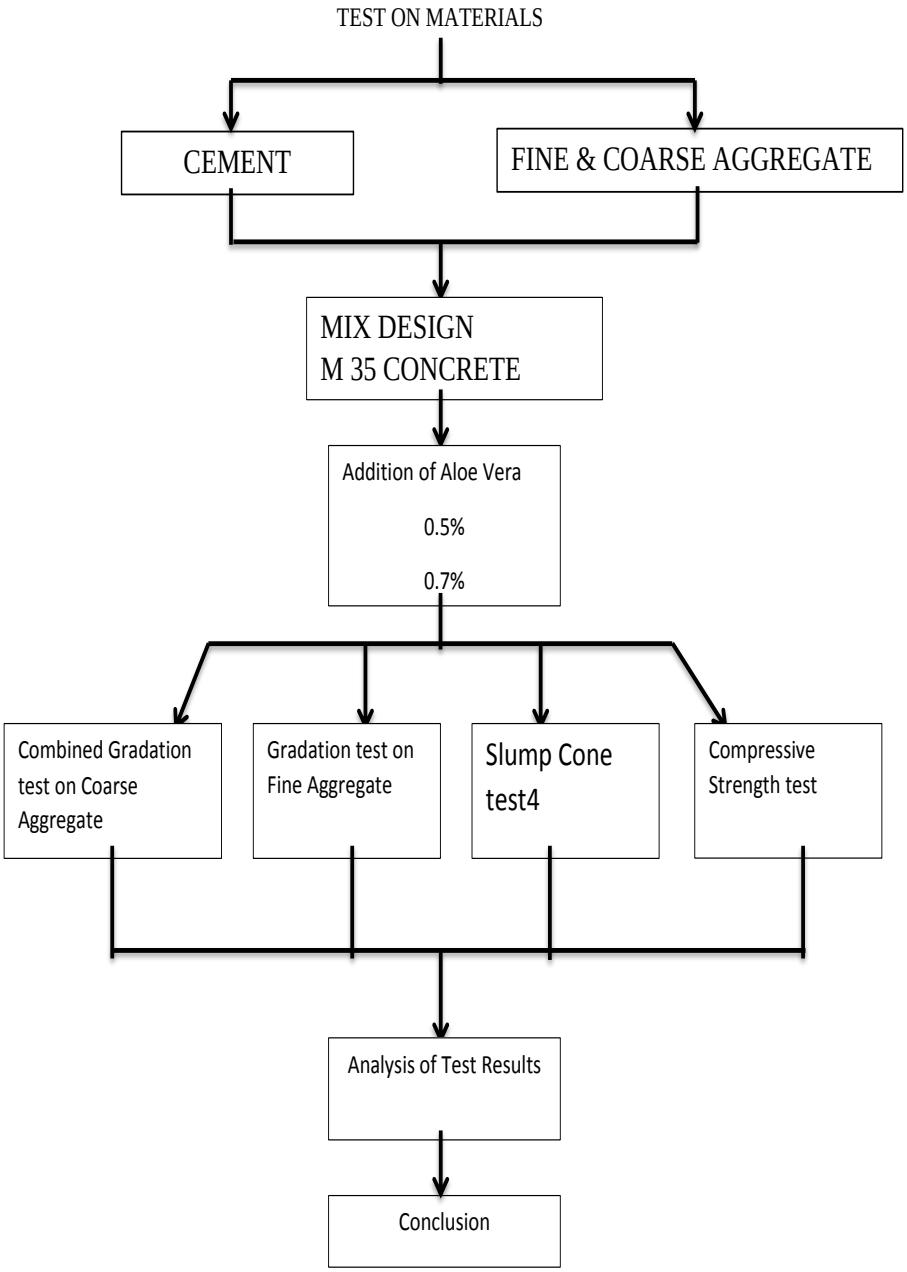

Figure 3.1 Methodology

V. EXPERIMENTAL PROCESS

5.1 Extraction of aloe vera juice

- We scrapped the pulp from aloe vera plant and extracted the gel by scooping it by a spoon.
- Then we grinded it and made juice without any addition of water.
- This extracted juice was then measure using a measuring jar in 0.5%, 0.7% and 1.0% of cement weight and kept aside.

Fig 5.1 Washing of aloe vera plant

Fig 5.2 Removing of thorns from the plant

Fig 5.3 Peeling of aloe vera

Fig 5.4 Scooping out of aloe vera gel

Fig 5.5 Grinded gel into juice

5.2 Concrete Mix

- For the conventional concrete, we added 2% of Master Rheobuild 923 HY chemical as admixture.
- We mixed the concrete in 3 batches with each concentration of aloe vera per batch.
- This concrete batch was termed as non-conventional concrete.

Fig 5.6 Measuring of aloe vera juice

Fig 5.7 Adding of aloe Vera juice to the concrete

Fig 5.8 Mixing of aloe vera juice with the concrete

5.3 Before Casting:

- The concrete mixture was tested for workability using a slump cone
- This test was done for each batch of varying proportion.
- The slump values for various mix ratios were noted.

5.4 Casting:

- We poured the concrete in cube moulds of size 150mmX150mmX150mm.
- A total of 36 cubes were casted to check the compressive strength at 7^{th}, 14^{th} and 28^{th} day with 9 cubes for each analysis respectively.

Fig 5.9 Casting of aloe vera concrete in cubes

5.5 Chemical Admixture Used For Conventional Concrete

Master Rheobuild 923 HY chemical admixture was used in conventional M35 concrete.

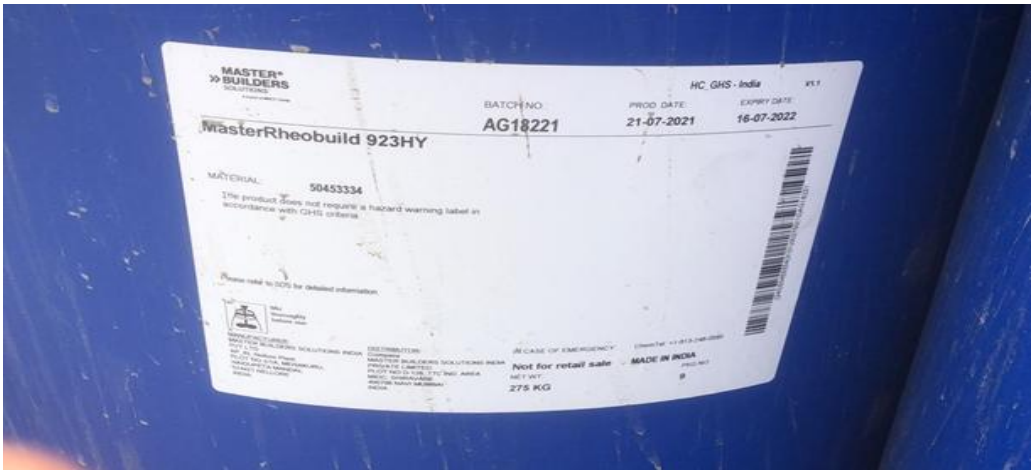

Fig 5.10 Master Rheobuild 923 HY

5.6 Final Result

- The aloe vera concrete was compared with conventional concrete under the given two parameters-

i. Workability
ii. Compressive strength

VI. TESTS ON CONCRETE

6.1 Slump cone 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 indicates the characteristic of concrete in addition to the slump value. If the concrete slumps evenly it is called true slump. If one half of the cone slides down, it is called shear slump. In case of a shear slump, the slump value is measured as the difference in height between the height of the mould and the average value of the subsidence.

Table 6.1 Workability readings for various composition of aloe vera juice

GRADE OF CONCRETE	ADMIXTURE USED	SLUMP VALUE (mm)
M35	Master Rheobuild 923 HY	215
	Aloe Vera gel (0.5%)	110
	Aloe Vera gel (0.7%)	150
	Aloe Vera gel (1.0%)	170

6.2 COMPRESSIVE STRENGTH TEST

Compressive strength test, mechanical test measuring the maximum amount of compressive load a material can bear before fracturing. The test piece, usually in the form of a cube, prism, or cylinder, is compressed between the platens of a compression-testing machine by a gradually applied load.

Table 6.2 Compressive Strength analysis after 7th, 14th and 28th day

DAYS	PROPORTION OF ALOE VERA ADDED(%)	VOLUME OF ALOE VERA ADDED(ml)	STRENGTH OBSERVED (Mpa)
7th day	0(Site mix)	0	32.15
	0.5	106	2056
	0.7	150	19.74
	1.0	210	19.32
14th day	0(Site mix)	0	31.5
	0.5	106	29.84
	0.7	150	29.23
	1.0	210	27.50
28th day	0(Site mix)	0	36.7
	0.5	106	34.63
	0.7	150	32.57
	1.0	210	32.17

VII. RESULTS AND DISCUSSION

7.1 WORKABILITY:

•From fig 6.1, we observe that the workability of conventional concrete with 2% chemical admixture was compared with concrete with 0.5% aloe vera juice admixture and it is observed that the workability is considerably less than conventional concrete.

•Also, when compared with 0.7% aloe vera concrete, there is considerable increase of 150mm in slump value than the previous 0.5% aloe vera ratio.

•Finally, the conventional concrete was compared with 1.0% aloe vera concrete.

•Also it was found that the workability for 1.0% aloe vera concrete is more or less on par with the 2% concentration of Rheobuild chemical admixture in concrete i.e. it showed an increase of 170mm slump value.

Here, we finally observe that as the concentration of aloe vera juice increases, the workability of the concrete increases.

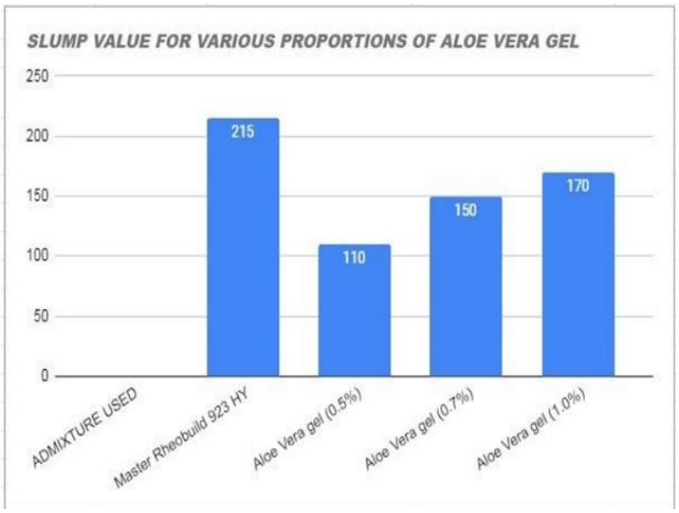

Fig 7.1 Analysis of Workability for different ratios of aloe vera juice in the concrete

7.2 COMPRESSIVE STRENGTH

•From the compressive strength, we can observe that at 28th day the compressive strength of 0.5% aloe Vera concrete is 34.63N/mm2.
•And at 0.7% of aloe Vera concentration, the compressive strength noted was 32.57N/mm2.
•Finally, the compressive strength of 1.0% aloe Vera concrete was found as 32.17N/mm2.
•Here, when the above proportions of aloe Vera concrete were compared with the conventional concrete with 2% chemical admixture, it showed that at 0.5% concentration only the compressive strength was higher and almost on par with the conventional concrete.
•But as the proportion of aloe juice increases, it was observed that the compressive strength of 0.7% and 1.0% of aloe vera concrete decreases and becomes constant.

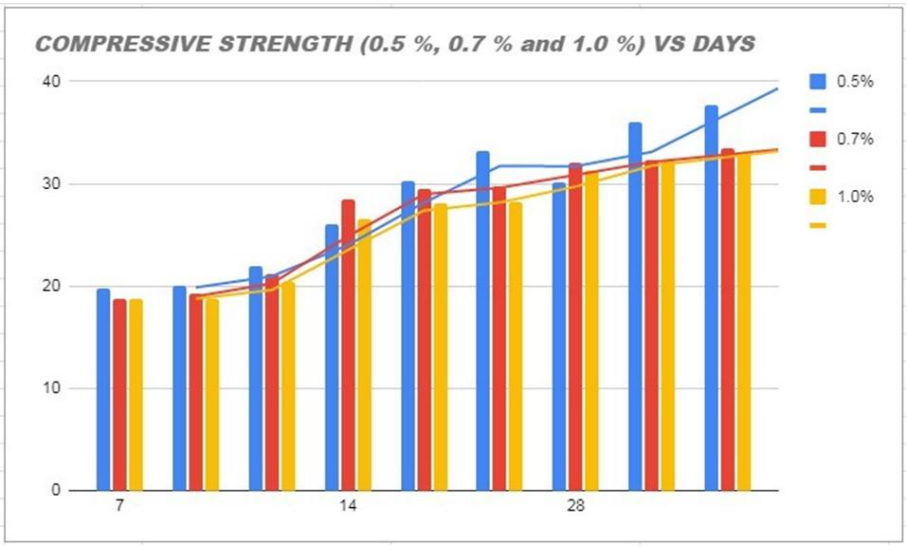

Fig 7.2 Analysis of Compressive Strength by comparing conventional concrete with aloe vera concrete

VIII. CONCLUSION

•The main aim of the slump test is to show how the different concentration of Aloe Vera juice alters the workability of concrete. Thus from the above analysis and results workability of concrete increases with concentration of Aloe Vera gel.
•But as we increase the concentration of aloe vera gel, the compressive strength of the concrete decreases which can be inferred from the graphical result analysis**.**
•It is observed that at 0.5% proportion of aloe vera gel, we can see a high compressive strength of 34.63 N/mm2 at 28th day observation, but as the concentration of aloe vera juice increases there is a slight and steady decrease in the compressive strength.
•This experiment with Aloe Vera juice in the concrete is done to study that the natural ingredients can also be used to increase the workability of the concrete.
•Since these mixtures are eco-friendly they are not harmful to the environment, yet the usage of cactus and aloe vera for the heavy construction are not possible. Hence as a try, small concrete specimens are made to find the compressive strength and workability.

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