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Experimental Investigation on Concrete by Loofah Fiber as Reinforcement and Partial Replacement of Cement by Coconut Shell ASH

[1]Mrs.S.Mithra,[2]R.Jayaatchaya,[3]G.Krithika,[4]R.Sona.
[1]Assisstant Professor, Department of Civil Engineering, Parisutham Institute of Technology And Science,Thanjavur,Tamil Nadu, India
[2] B.E. student, Department of Civil Engineering, Parisutham Institute of Technology And Science, Thanjavur, Tamil Nadu, India
[3] B.E. student, Department of Civil Engineering, Parisutham Institute of Technology And Science, Thanjavur,Tamil Nadu, India
[4] B.E. student, Department of Civil Engineering, Parisutham Institute of Technology And Science, Thanjavur, Tamil Nadu, India

Abstract *- The primary aim of the project is to obtain a strength on concrete by using loofah fiber as a reinforcement and coconut shell ash as a cementitious material. The loofah fiber (also known as sponge gourd) is economical and it's a natural fiber reinforcement. The loofah fiber is treated with 4% of con.NaOH (1N) solution for 24 hours and then washed in distilled water. The coconut shell ash is an excellent cementitious material used as partial replacement of cement. This coconut shell was sun dried for 48 hours to remove moisture from it and burnt for 3 hours and then allowed to cool for about 12hours.The burnt ash was collected and sieved through a IS sieve (75 microns). These two materials are an eco-friendly and help to reduce the carbon-di-oxide[co2] emission of concrete. The mix ratio is M25 and Luffa fiber was added to the concrete at 0,1%,2%,3%,4% percentage and replacement of cement with coconut shell ash at 0%,5%,10%,15%,20% and 25%. The mould used for casting concrete are cube (150mm×150mm×150mm),cylinder(150mm×300m m). The compressive strength test, split tensile strength test of casted concrete are noted along with the curing period of 7,14 and 28 days.*

Keywords: *Loofah fiber, Coconut shell ash, Compressive strength, Tensile strength.*

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I. INTRODUCTION

In this project loofah fiber is add as reinforcement and partially replaced cement with coconut shell ash. The fiber reinforcement is a viable method to improve the material properties of biodegradable polymers and to reduce the overall costs of the materials. Loofah fiber (sponge gourd) is such a natural fiber extracted from the sponge- gourd plants and is extensively grown in India, Asia and Africa. Recently, uses of Loofah fiber as reinforcing material in fabrication of polymer- Loofah fiber composites have raised great interest and expectations among materials scientists and engineers. It is a rapidly developing material with the attractive advantages of low density and cost compared to metals and other forms of fiber reinforcements. Luffa grows straight arrow, curved, and grows about 200 mm in length. Luffa family has found several uses such as edibles present in the market, as bath sponges, filler materials for production of composites, materials of adsorption in water treatments, for discoloration of reagent, extraction of harmful chemical and biological compounds, in the cosmetics industries among others. In the present scenario, natural fibers have excellent potential to reduce not only CO2 emissions but also save non-renewable resources by substituting artificial fiber reinforcements in composites. By treating the loofah fiber with 4% of NaOH solution will increase the strength and durability of the fiber as well as for concrete. After washed with distilled water and dried in room temperature for 24hours.Agricultural waste disposal of materials such as rice husk, groundnut husk, corn cob and coconut shell ash have constituted an environmental challenge, hence the need to convert them into useful materials to minimize their negative effect on the environment. Research indicates that most materials that are rich in amorphous silica can be used in partial replacement of cement. It has also been established that amorphous silica found in some pozzolanic materials reacts with lime more readily than those of crystalline form. Use of such pozzolanas can lead to increased compressive strength. The properties like compressive strength, tensile strength.

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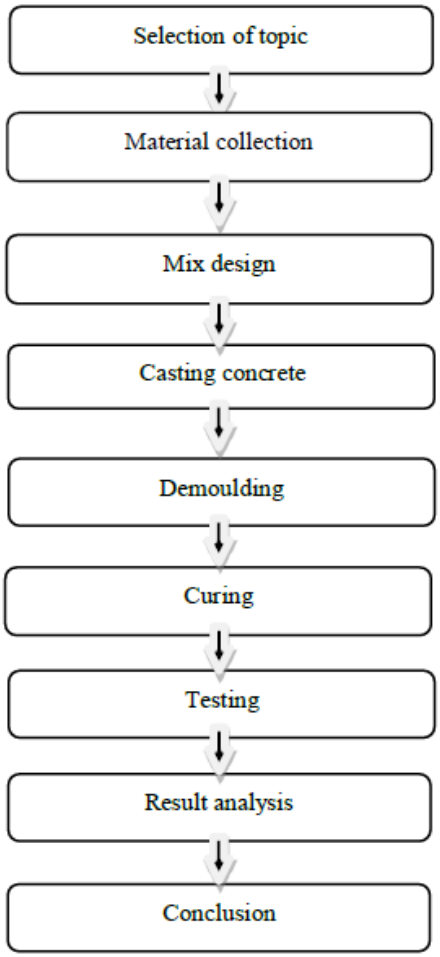
II.METHODOLOGY AND MATERIALUSE

2.1 Methodology:



2.2 MaterialUse:

2.2.1 Cement:

Cement is a adhesive substances of all kinds, but, in a narrower sense, the binding materials used in building and civil engineering construction. Cements is a kind of finely ground powders that, when mixed with water, set to a hard mass. Setting and hardening result from hydration, which is a chemical combination of the cement compounds with water. In this project ordinary portland cement [OPC] is used.

2.2.2 Fine Aggregate:

Fine aggregates generally consist of natural sand or crushed stone with most particles passing through a 4.75 mm IS sieve and zone-II of IS: 383- 1970 was used.

2.2.3 Coarse Aggregate:

Coarse aggregates are larger size filler material. Coarse aggregate are the particles retain on 4.75 mm IS sieve and size of 20mm is used. The specific gravity was 2.74.

2.2.4. Loofah Fiber:

Loofah fiber also termed luffa gourd or luffa sponge, is a natural fiber that has a solid potential to replace synthetic fibers in composite materials. Before using the loofah fiber the seeds removed from them and the fibers were cut. The cutted samples were treated with 4% wt. NaOH concentration. The luffa fibers were fully immersed in the NaOH solution and the treated for 24 hours under normal room temperature. After that the luffa fibers were thoroughly rinsed in distilled water and the luffa fibers were dried under direct sunlight to remove the moisture content then cut the luffa fibers were weighed and stored appropriately. In this project luffa fiber is added at 0%,1%,2%,3%,4%.

Fig.2.1 Luffa fiber treated in chemical

2.2.5 Coconut Shell Ash:

The coconut shell in the form of ash is a material which can be used as a substitute of cement. The research indicates that the materials rich in amorphous silica can be used as partial replacement of cement. Use of such material can lead to increase the compressive and flexural strength. In this project coconut shell ash is used at 5%,10%,15%,20% and 25% as a replacement of cement.

Fig.2.2 Coconutshell ash

2.2.6 Alkaline Treatment:

Alkaline treatment is one of the most used chemical treatments of natural fibers when used to reinforce. The modification done by alkaline treatment is the disruption of hydrogen bonding in the structure, thereby increasing surface roughness. This treatment removes a certain amount of lignin, wax and oils covering the external surface of the fiber cell wall. Thus, alkaline processing directly influences the cellulosic fibril and the extraction of lignin and hemi-cellulosic compounds. Alkaline treatment has an effect on the mechanical behavior of flax fiber, especially on fiber strength and stiffness.

III. EXPERIMENTALWORK

Table3.1 Mix Design Proportion

Grade ofconcrete=M25

Cement	Fine aggregate	Coarse aggregate	Water
425	698.50	1131.40	186
1	1.642	2.66	0.45

IV. RESULT& DISCUSSION

The strength result is obtainedat7,14,28days of the concrete mixes designed as per Indian code.

4.1 Compression Test:

Table-4.1 Contains the values of conventional concrete during the compression test for cube.

No. of days	7	14	28
Conventional concrete [MPa]	14	21.55	31.56

Table-4.2 Contains the values of replacement (coconut shell ash) during the compression test. (MPa)

Percentage/ No. of days	7	14	28
0%	14	21.55	31.56
5%	19.83	22.88	32.51
10%	20.66	26.32	32.80
15%	18.40	23.7	32.01
20%	16.11	25.41	30.89
25%	15.56	21.55	28.91

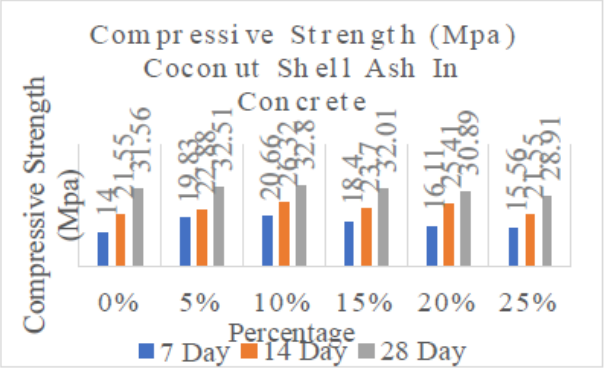


Fig.4.1 compressive strength of CSA (MPa)

Table-4.3 contains the values of replacement (Loofah Fiber) during the compression test. (MPa)

Percentage/ No. of days	7	14	28
0%	14	21.55	31.56
1%	21.64	27.08	32.52
2%	21.02	26.9	32.13
3%	20.86	26.43	31.74
4%	20.53	25.89	30.02

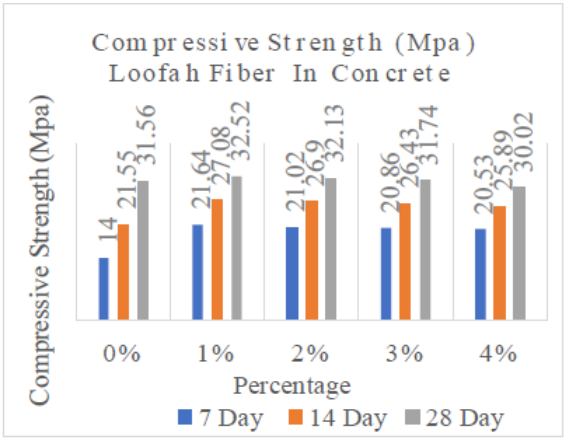


Fig.4.2 compressive strength of LF (MPa)

4.2 Split Tensile Test:

Table-4.4 Contains the values of conventional concrete during the split tensile strength for cylinder.

No. of days	7	14	28
Conventional concrete [MPa]	1.51	2.12	3.5

Table-4.5 Contains the values of replacement (coconut shell ash) during the split tensile test (MPa)

Percentage/ No. of days	7	14	28
0%	1.51	2.12	3.5
5%	1.27	1.69	2.33
10%	1.34	1.83	2.54
15%	1.20	1.62	2.36
20%	1.14	1.57	2.20
25%	0.90	1.24	2.19

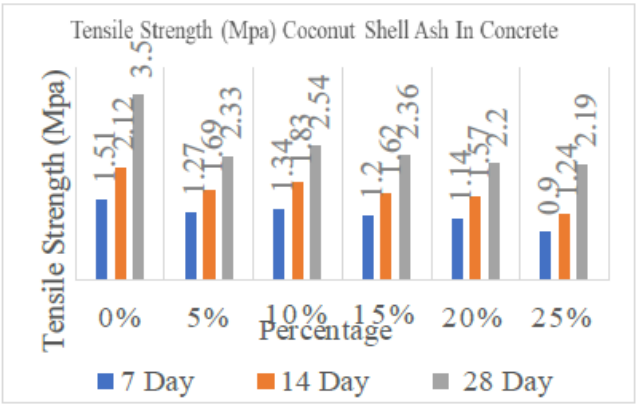


Fig.4.3 Tensile strength of CSA (MPa)

Table-4.6 contains the values of replacement (Loofah Fiber) during the split tensile test. (MPa)

Percentage/ No. of days	7	14	28
0%	1.51	2.12	3.5
1%	2.78	3.97	4.15
2%	2.52	3.65	3.82
3%	1.90	2.84	3.13
4%	1.37	2.30	2.74

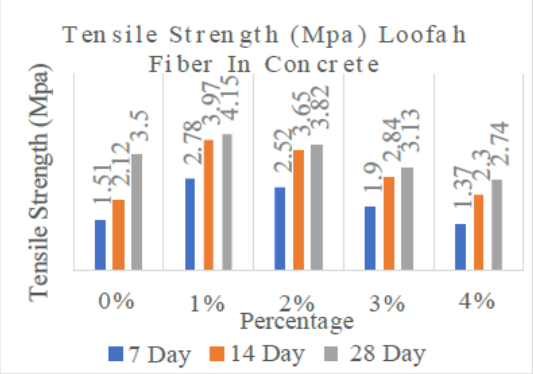


Fig.4.4 Tensile strength of LF (MPa)

Table 4.7 Combined materials in concrete during compression test (MPa)

DAYS	7 day	14day	28 day
CSA[10%]+LF[1%]	21.15	26.7	32.84

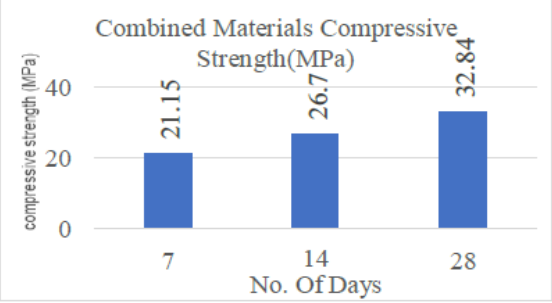


Fig.4.5 Combined materials compressive strength (MPa)

Table 4.8 Combined materials in concrete during split tensile test (MPa)

DAYS	7 day	14day	28 day
CSA[10%]+LF[1%]	2.06	2.9	3.2

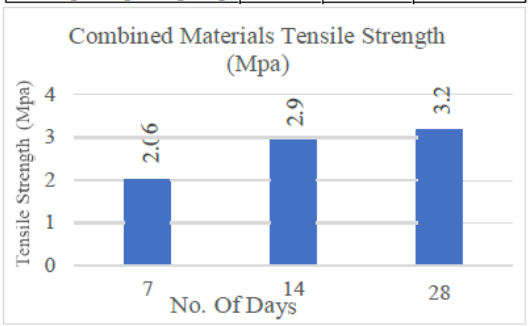


Fig.4.6 Combined materials tensile strength (MPa)

V. CONCLUSION

Here by conclude that the combination of loofah fiber in concrete has been increase the strength up to 1% and the combination of coconut shell ash in concrete has increased in 10% of replacement. Hence the combined of materials coconut shell ash + loofah fiber in concrete has achieve more than the target strength.

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