

Control Environmental Issues Using Natural Wastage in Concrete

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ABSTRACT

Everyone knows that environment is one of the basic need or assets of leaving system but many harmful prospects like green house effect, rise in temperature, climate changes etc. are increasing only due to deforestation and rise of artificial or man-made wastage such as non-degradable garbage. Non-degradable garbage such as natural human hair, sugarcane ash etc, is one of the major reason of harmful environmental issues and this paper showing a beneficial way to solve this major problem. So, present experimental study is based on to use the non-degradable garbage like natural human hair and sugarcane ash as fibrous material in different percentages in concrete which is a popular construction composite material using huge in worldwide construction of structures, to increase its mechanical attributes so that it can provide better strength to structures in very cheap cost. These unique experimental findings on concrete and unique way of reducing environmental problems will be definitely helpful for leavings and encourage future researches in same direction.

key words: Non-degradable wastages, Natural Human Hair, Sugarcane Fibers, Compressive Strength of Concrete, Flexural Strength, Split Tensile Strength etc.

INTRODUCTION

Environment literally means Surrounding in which we are living and it includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non living component like soil, air water but unfortunately it is going to be pollute very fast only due to sensible living beings because of use in large quantity of fossil fuel and carbon emissions, increases non-degradable substances, harmful chemical etc. Non-degradable wastage is one of the major problem can be reduced by using itself in concrete as reinforcing material to increase up the mechanical properties such as Compressive Strength, Flexural Strength, Split Tensile Strength etc of concrete.

Concrete is a composite material produced by mixing the binding material such as cement, different sizes of aggregates and water, possessing low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks are inherently present in concrete and its poor tensile strength is due to the propagation of such micro cracks eventually leading to brittle fracture of the concrete. Fibers could prevent cracking and substantially improve the tensile strength, ductility etc of concrete so in present study human hair and sugarcane fibers are used as reinforcing material which creates lot of environmental problems because of their non-decomposition.

Natural Human hair is strong in tension or has great tensile strength which is nothing but equal to that of a copper wire with same diameter and sugarcane fibers also has great reinforcing properties which helps to improve many concrete attributes. It is an alternate non-degradable matter is available in abundance and at a very cheap cost and creates environmental problem for its decompositions hence it can be used as a fiber reinforcement material in concrete to convert it normal concrete to fiber reinforced concrete.

[1]Fiber helps to make earthquake resistance structure & they provide better ductility and stiffness. [2]Fibers are added in concrete by dissolved in water & it taken by weight of binding material. [3]Natural Horse hair fiber helps to improve tensile & flexural strength of concrete and density of concrete is not depends on horse hair fiber. By increase the fiber percentage, density reduced slightly. [4]Fibers are added in dry sand instead of concrete by manually distribution. Human Hairs helped to improve chemical and biological properties of soil and Load bearing capacity of soil was increased by using human hair.

2. Objective and Scope

The main objective of this study is to protect environment from non-degradable wastages spreading by human beings, which are increasing continuously and polluting surroundings, by using in concrete to make it better construction material economically. This contribution work will help to get an idea to control environmental issues by beneficially use of discussed wastages.

3. Experimental Work

3.1 Materials and their Properties

Many types of material are used in this work to produced fiber reinforced concrete, discussed below:

Cement: In this experimental work Ordinary Portland Cement of 53-grade and 3.14 of specific gravity, is used as binding material with as per IS code 12269:1989.

Aggregates: Aggregates are used in concrete to achieve strength and remove air voids. There are two types of aggregates- Fine aggregates (<4.75 mm size and 2.63 specific gravity) which help to remove voids and coarse aggregates (4.75 – 20 mm size and 2.74 specific gravity) which help to achieve strength.

Reinforced Materials: The use of it in concrete instead of steel bars is, to provide the better tensile strength and ductility to structures. Here natural human hair (NHH) and sugarcane fibers (SCF) are used in different percentages (0.25% and 0.5%) by weight of binding materials and aggregates, and different important parameters related to these fibers are given in table I. Fibers are described by aspect ratio which is nothing but ratio of length to its diameter and typical aspect ratio range lies 200 to 300.

Table I Some Parameters of Reinf. Materials

Reinforced Material	Parameters	Average values
NHHF & SCF	Diameter range	50 μ m – 100 μ m
	Length of Fiber	10mm – 30mm

3.2 Preparation of Specimens

In this investigation, IS code 10262:2009 is used for preparing M30 concrete mix, with standard water cement ratio of 0.42 to prepare standard sizes of 100 x 100 x 100 mm cubical specimens, 500 x 100 x 100 mm prisms and 100 x 200 mm cylindrical specimens for compressive strength test, flexural strength test and split tensile strength test respectively. All discussed materials were mixed with each other in drum type mixing machine with standard quantity of water and fibers which are added in different percentages (0.25% and 0.5%) with manual distribution. After proper mixing of all materials and fibers, FRC mix put in cubical, prism and cylindrical moulds in three different layers. Machine vibrator is also used to remove voids from moulds so that it can be filled properly with concrete mix. After 24-hours, moulds were de-moulded and kept it in water tank for 28-days of curing period as per IS Standard.

3.3 Testing of Specimen

Mechanical properties of FRC were found under monotonic load by compression testing, flexural and split tensile testing as shown in fig I, are as follows:

Compression Test: This test is used to find compressive strength (N/mm²) of concrete by applied axial load on cubical samples by universal testing machine of 2000 kN capacity. Ultimate compressive strength of specimen is the value of uni-axial compressive stress reached when the material fails completely under applied load.

Flexural Strength Test: This test is conducted on flexural strength testing machine under Centre-point loading or three-point loading, to find tensile strength or flexural strength of concrete beams or prisms with the help of

mathematical equation named as ‘Bending Equation’. It also defined as the stress in a material or specimen just before it yields in a flexure test.

Split Tensile Strength: This test is conducted on cylindrically shaped specimens by transverse loading on universal testing machine to find split tensile strength in which specimen is subjected to a controlled tension until failure.

4. Results and Discussion

After a detailed investigation and findings on fiber reinforced concrete as shown in table II, in which non-degradable substances are used as fibrous material to increase concrete attributes and protect environment, it found that Compressive strength of 0.25% human hair FRC samples and 0.25% sugarcane samples increased 17.8% and 9.7% respectively, and of 0.50% human hair and 0.50% sugarcane samples increased 12.9% and 5.7% respectively, when it compared with control specimen results.

Table II Test Results with or without fiber

Specimens Details	Compressive Strength (N/mm ²)		Flexural Strength (N/mm ²)		Tensile Strength (N/mm ²)	
	HHF	SCF	HHF	SCF	HHF	SCF
Control	39.6	39.6	6.48	6.48	6.26	6.26
With 0.25% Fibers	46.7	43.5	8.01	7.60	7.67	7.26
With 0.50% Fibers	44.7	41.9	8.49	7.78	7.93	7.41

Similarly, flexural strength of 0.25% human hair & sugarcane fibers and 0.50% human hair & sugarcane fibers increased 23.7% & 16.9% and 31.1% & 18.7% respectively. And split tensile strength of 0.25% human hair & sugarcane fibers and 0.50% human hair & sugarcane fibers increased 22.5% & 15.9% and 26.7% & 18.4% respectively. There is also found that different specimens with human hair and sugarcane fiber were more stretchable and stiffer as compared to control specimens and crack propagation changed to ductile from brittle manner in FRC samples as shown in fig I.



Fig. I Different Testing and Crack Propagation

5. Conclusion

Natural Human Hair fibers and Sugarcane fibers are provided great improvement in concrete properties and helped to make it ductile material. There is a great increment in human hair FRC samples attributes as compared to sugarcane samples but when both types of samples compared with control, gave excellent result. Overall, with addition of 0.50% fibers in concrete provided great results so according to experimental findings, both the natural fibers can use in concrete to increase its properties. This study found dual benefit of use of natural fibers in concrete in which first is concrete can improve its attributes and gain more strength in very low cost and second is harmful environmental issues which born from non-degradable garbage or wastage, can reduce easily in beneficial way.

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