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FIBRE REINFORCEMENT CONCRETE WITH HUMAN HAIR AND PARTIAL REPLACEMENT OF FINE AGGREGATE BY STEEL SLAG

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Abstract – *This project presents the study on fibre reinforced concrete is one among those advancements which offers convenient, practical and economical methods for overcoming micro cracks and similar type of deficiencies. Since the concrete is weak in tension, fibre help to overcome this deficiency. There are several types of fibre which serves this purpose, this paper investigates the suitability of human hair. This paper compares the strength and durability of ordinary concrete with hair fibre reinforced concrete of M30 grade with 0%, 0.5%, 1% 1.5% addition of hair by weight of cement. The result shows that addition of human hair fibre enhances the binding properties, micro cracks control, imparts ductility and also increases the spalling resistance. The experimental findings in overall studies would encourage further research in this direction for long term performance to extending this cost-effective type of fibres for use in structural application.*

Key Words*: *Human Hair Fibre, Compressive Strength, Flexural Strength, Tensile Strength, Steel slag

1. INTRODUCTION

Fibre Reinforced Concrete (FRC) can be defined as a composite material including all the ingredients of concrete along with fibres as a reinforcing agent to overcome the micro or hair-line cracks. The concrete free from micro-cracks and similar type of deficiencies and can also give a tensile strength slightly equal to that of steel. Concrete is most widely-used Man made construction material and studies indicate that it will continue to be so in the years and decades to come. Such versatility of concrete is due to the fact the common ingredients, namely cement, sand, coarse aggregate and water. Concrete is good in compression and also it is very strong in carrying flexural force. A Reinforced concrete section, where the concrete resists compression and the steel resists the tension.

1.1 PROBLEM STATEMENT

When concrete less tensile strength, its durability, strength and abrasive resistance are affected. Due to concrete develops plastic shrinkage cracks, thermal cracks, micro cracks along with a considerable loss in the strength of the surface layer. Surface results in plastic shrinkage cracks and a weak and dusty surface.

An excessive temperature difference between the outer and the inner layers of the concrete results in thermal cracking due to restraint to contraction of the cooling outer layers from the warmer inner concrete This results in irretrievable strength loss and makes concrete porous.

1.2 Advantages of fibre reinforced concrete

Fibre reinforced concrete has started finding its place in many areas of civil infrastructure applications especially where the need for repairing, increased durability arises. FRC is used in civil structures where corrosion is to be avoided at the maximum. Fibre reinforced concrete is better suited to minimize cavitation /erosion damage in structures such as sluice-ways, navigational locks and bridge piers where high velocity flows are encountered. A substantial weight saving can be realized using relatively thin FRC sections having the equivalent strength of thicker plain concrete sections.

1.3 Disadvantages of fibre reinforced concrete

The main disadvantage associated with the fibre reinforced concrete is fabrication. The process of incorporating fibres into the cement matrix is labor intensive and costlier than the production of the plain concrete. The real advantages gained by the use of FRC over rides this disadvantage.

2. LITERATURE REVIEW

Ramya. T and Tamilamuthan. B (2017)

The hair fibre reinforced concrete. But what exactly is it? The strict Environmental regulations and economical purpose recycling of saloon waste hair the use of alternative Eco- Friendly Natural reinforcements to produce advanced composite materials. The large quantities of human & animal's hair fibre are not always well managed or utilized. In India, three to four tons of human hair fibre wasted annually. These composites are having low density and cost as well as satisfactory mechanical properties make them an attractive due to easy availability and renewability of raw materials.

Sreevani. G, Smt.B. Ajitha (2017)

The concept of using fibres as reinforcement is not new. fibres have been used as reinforced since ancient times. Historically, +horsehair was used in mortar and straw in mud bricks. In the early 1900s, asbestos fibres were used in concrete, and in the 1950s the concept of composite

materials came into being and fibre reinforced concrete was one of the topics of interest.

S.Aishwarya, John Sathiya Raj, Nidhe Narayan (2017)

Concrete is weak in tension and has a brittle character. Use of fibres in discrete from in a plain concrete may provide a better solution. Addition of fibres to concrete makes it a homogeneous and isotropic material that arrests crack formation and propagation, and thus improve strength. Fibre-Reinforced Concrete (FRC) is concrete containing fibrous material which increases its structural integrity. Fibres are of wide range and can be categorized as natural and manmade fibres.

Engr. Fawad Khan, Dr. Khan Shahzada (2018)

Concrete is one of the most broadly utilizing material in construction industries; it is generally consisting of three main elements: cement, sand and Coarse aggregates, they are bonded together by cement and results in concrete which in fact an artificial stone. Its compressive strength is higher than tensile strength.

Tomas u, Ganiron Jr (2014)

During the last seventy years in Manila, there was an unprecedented development in infrastructure, particularly on roads. Many thousands of kilometres of new roads were constructed worldwide to meet the demands of increasing traffic volumes. Many of these roads have been used for more than twenty years and have reached the end of their design lives, requiring increasing maintenance efforts to retain acceptable levels of service.

3. EXPRIMENTAL DETAILS

3.1 Material used and Test

The different types of material used in the investigation are given below:

i. Cement
ii. Fine aggregate
iii. Coarse aggregate
iv. Water
v. Steel slag
vi. Human hair

Cement:

Cement used 53 grade Ordinary Portland cement (OPC) IS:12269-1987.

Physical Properties of Cement		
1	Specific gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min

Fig-1&2: Specific test and Initial setting time

Fine aggregate:

The fine aggregate conforming to zone II according to IS 383-1970 was used. The fine aggregate is a M-Sand for buying karur.

The M-Sand is almost used to construction field to replace by sand, the sand not availability from Tamil Nadu. So the M-Sand is mostly probable.

Physical Properties of M-Sand		
1	Specific gravity	2.67

Fig -3: Specific gravity test of M-Sand

Coarse aggregate:

The coarse aggregate used is procured from a load crushing unit having a 20mm nominal size. Well graded aggregate according to IS 383 is used in this investigation. The coarse aggregate used was obtaining from a Venkateshwara blue metals.

Coarse aggregates are a construction component made of rock quarried from ground deposits. Examples of these kinds of ground deposits include river gravel, crushed stone from rock quarries, and previously used concrete. Coarse aggregates are generally categorized as rock larger than a standard No.

Physical Properties of Coarse aggregate		
1	Specific gravity	2.9
2	Fineness modulus of coarse aggregate	4.86

Fig -4: Specific gravity test of Coarse aggregate

Fig -5: Fineness modulus test of Coarse aggregate

Steel slag:

The steel slag a by-product of steel making, is produced during the separation of the molten steel from impurities in steel- making furnace. The slag occurs as a molten liquid melt and is a complex solution of silicates and oxides that solidifies upon cooling.

Physical Properties of steel slag		
1	Specific gravity	2.57

Fig -6: Specific gravity test of Steel slag

Human hair:

Hair is used as a fibre reinforcing material in concrete for the reasons: It has a high tensile strength which is equal to that of a copper wire with similar diameter. Hair is a non-degradable matter is creating an environmental problem so its use as a fibre reinforcing material can minimize the problem. It is also available in abundance and at a very low cost. It reinforces the mortar and prevents it from spalling.

Mix proportion:

Material used		
1	Cement	438.2 kg/m^3
2	Coarse aggregate	1194 kg/m^3
3	Fine aggregate	673.7 kg/m^3
4	Water	197.2 lit/m^3
5	Steel slag 5% of Cement weight	33.68 kg/m^3
6	Human hair 0.5 % of Cement weight	12.05 kg/m^3

M30 mix design ratio = 1:1.5:2.7

Fig -7: Mix proposition

4. Workability test:

Slump test

The slump flow test, using the traditional slump cone is the most common field test. The slump cone is completely filled without consolidation, the cone lifted, and the spread concrete measured. The slump floe test, the viscosity of the SCC mixture can be estimated by measuring the time taken for the concrete to reach a spread diameter of 300 mm from the moment the slump cone is lifted up.

The slump flow value is = 110 mm.

Fig -8: Slump flow test

5. Test for hardened concrete

Compressive strength of concrete

The compressive strength of samples was tested after 7 days. The chart shows the variation in strength with is as we have used 1% of PEG-400 and 0.5% sanal to the concrete, the strength increased to the conventional concrete. We are increase the strength of the concrete for 7 days. Tested for cube and Cylinder compressive strength.

Fig -9: Compressive strength for Cube

Compressive strength for Cube

unit=N/mm^2

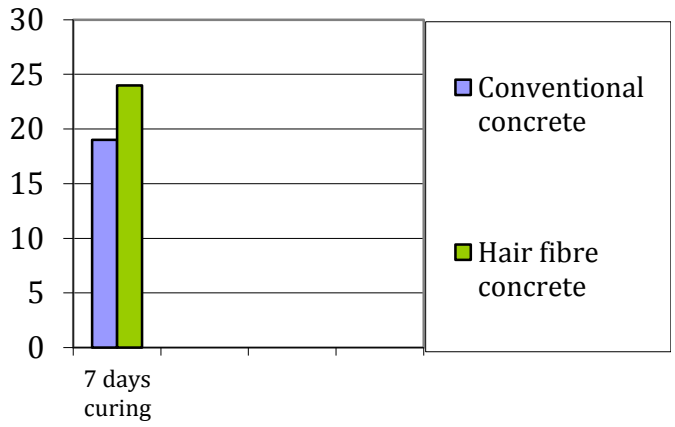

chart-1: compressive strength of 7 days curing

Compressive strength for Cylinder

unit=N/mm^2

Fig -9: Compressive strength for Cylinder

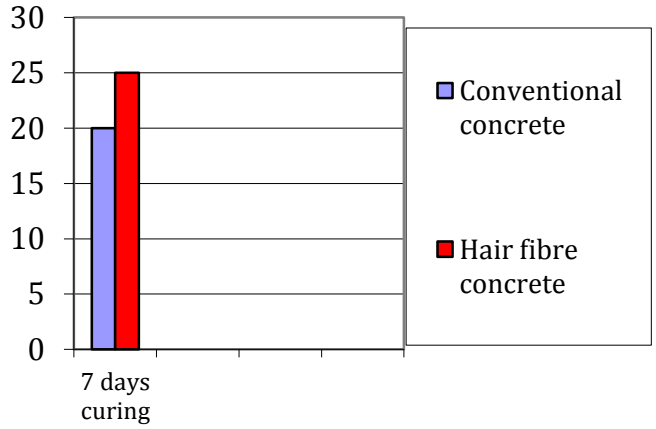

chart-2: Compressive strength for Cylinder

6. CONCLUSION

The human hair fiber concrete has the high compressive strength compared to the normal Concrete. Better split tensile strength was achieved with the addition of the human hair in concrete. The strength has increased. When compared to that of the conventional concrete specimen.

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