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Experimental Work On Rigid Pavement By Using Hair Of Human For Better Performance

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Abstract - *Upgrade the physical and mechanical properties of cement are an expected area of exploration. Fiber supported concrete is one among those best in class which offers helpful, down to earth and prudent techniques for conquering miniature breaks and comparative sort of lacks. Since the substantial is powerless in pressure, fiber assists with defeating this lack. There are various fiber types accessible for business and trial use. The basic fibre used in construction is steel, glass, synthetic and natural fibre materials. Human hair is generally strong in tension, hence it can be used as a fiber reinforcement material. Hair fiber shall be an alternate and low cost material for remote locations of Jammu and Kashmir were Fiber Reinforcement Concrete are hardly practiced. Experiments were conducted on concrete with addition of human hair fiber i.e., 0%, 0.5%, 1%, 1.5%, 2%, and 3% by weight of cement and results are compared with those of plain cement concrete of grade M20. There is an augmentation in the strength of cement by the expansion of human hair as fiber support which makes it appropriate for an elective added substance for cement to upgrade its mechanical properties. Hair fiber concrete can be used for construction in Jammu and Kashmir were use of fiber in concrete is less cited due to lack of local vendors and higher market rates.*

Key Words: Fiber Reinforced Concrete, Human Hair Fibre, Compressive Strength, Flexural Strength, Crack Resistance.

1. INTRODUCTION

Definition and history of cement is a material utilized in building development, comprising of a hard, synthetically latent particulate substance, known as a total (normally produced using various sorts of sand and rock), that is fortified together by concrete and water. In 1756, British specialist, John Smeaton made the primary present-day concrete (pressure driven concrete) by adding stones as a coarse total and blending controlled block into the concrete. In 1824, English creator, Joseph Aspdin designed Portland concrete, which has stayed the prevailing concrete utilized in substantial creation. Joseph Aspdin made the main genuine fake concrete by consuming ground limestone and dirt together. The burning process changed the chemical properties of the materials and Joseph Aspdin created stronger cement than what using plain crushed limestone would produce.

Fake filaments are artificial strands in which essential substance units produced by synthetic amalgamation. Regular strands are named hair like material which is acquired from trimming creature hair and plants. Synthetic fibres can be produced at very low cost and in huge quantities as compared to natural fibres. Fibres which are commonly used in construction industry are steel fibres, glass fibres, synthetic fibres, and natural fibres. Filaments having short length are blended in plain cement for working on its weak way of behaving and granting the pliability. This new kind of cement having short discrete strands spread toward all path is alluded as fiber supported concrete (FRC).

Fiber Reinforced Concrete will be concrete containing stringy material which increments as primary and is acquiring significance. It contains short discrete filaments that are consistently appropriated and haphazardly situated. The idea of involving filaments as support isn't new. Filaments have been utilized as built up since old times. All things considered, horsehair was utilized in mortar and straw in mud blocks. In the mid 1900s, asbestos filaments were utilized in concrete, and during the 1950s the idea of composite materials appeared and fiber supported concrete was one of the subjects of interest. Afterward, the utilization of asbestos for substantial support was deterred because of the related wellbeing chances. New materials like steel, glass, and manufactured strands traded asbestos for support.

Fibres can be reduced permeability of concrete as well as bleding of concrete. Fibres interlink and entrap around the aggregate particles and mixing of these are more cohesive so that reduce the workability. Fibresin concrete control cracks due to plastic shrinkage and drying shrinkage.

Human hair is a waste material which is found in abundant amount in everyday life. It is a very common constituent in muncipal waste streams and causes environmental problems as it is anon degradable waste. Also, human hair is very stong in tension. As plain concrete is weak in tension number of techniques are being developed to overcome this deficieney.Sustainable

concrete involves use of such materials which fulfill both requirements i.e. improve srenghth and materials should be available in local market at affordable amount.Hence hair can be used as fibres in concrete.

Hair is used as a fibre reinforcing material in concrete for the following reasons:

1. It has a high tensile strength which is equal to that of a copper wire with similar diameter.

2. Hair a non-degradable matter is creating an environmental problem so its use as a fibre reinforcing material can minimize the problem.

3. It is easily available in huge amount.

4. Very cheap cost.

5. Increment in various properties of concrete and the strength of concrete by addition of hair fibre as an additional reinforcement.

6. Cracking control to economize concrete.

7. Very fine human hair fibres can be used for partial replacement of cement in Concrete.

Incorporated into concrete at content of 0.5, 1, 1.5, 2, 2.5 and 3% by weight of cement. 3D squares and barrel shaped examples are casted and relieved appropriately for assessing different properties. These examples made of human hair fiber built up concrete are tried at 3, 7 and 28days and the adjustment of properties when contrasted with plain concrete cement is noticed

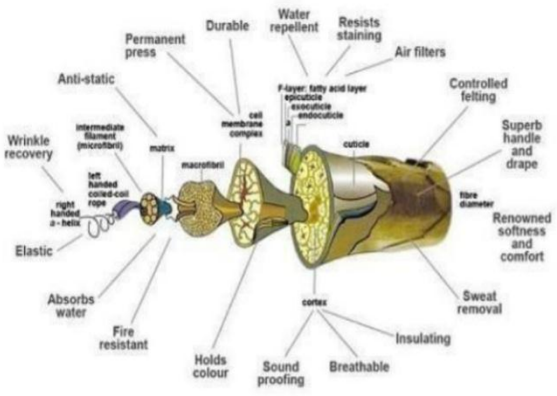


Fig.1.1 Schematic Representation of Micro Structure of Human Hair Fibre

LITERATURE REVIEW

This chapter includes the background information to be considered in the project work.

- Rohini B. Borkar.et.al (2018), RTMNU University published a paper on "Experimental Analysis and Application of Human Hair as a Fibre Reinforcement in Concrete" to study the effects of human hair on plain cement concrete on the basis of its compressive strength, flexural strength etc. Experiments were conducted on concrete beams and cubes with various percentages of human hair fibre i.e. 0%, 19%, 1.5%,2%, 2.5%, 3%, 3.5%, 4%,4.5%, 5% by weight of cement. For each gathering of extents of cement footer and solid shapes of standard sizes are tried for their mechanical properties at relieving times of 7, 14 and 28 days. By testing of shapes and shafts there is a raise in the different properties and strength of cement by the expansion of human hair as fiber substantiation in concrete.

- G. Sreevani, and Smt. B. Ajitha (2017), JNT University, published a paper on "Human Hair as Fibre Reinforcement in Concrete" to enhance the physical and mechanical properties of concrete. Experiments were conducted onconcrete cubes, cylinders and beams of standard sizes with addition of various percentages of human hair fiber i.e., 0%, 0.5%, 1% and 1.5% by weight of cement, fine & coarse aggregate and results were compared with those of plain cement concrete of M-20 grade. For each percentage of human hair added in concrete, four cubes, three cylinders and three beams were tested for their respective mechanical properties at curing periods of 3 ,7 and 28 days. Optimum hair fiber content was obtained as 1.5% by weight of cement.

- S. Aiswarya.et.al (2017), Dr. B. R. Ambedkar Institute of Technology, published a paper on "Experimental Investigation of Hair Fibre Concrete as an Alternative Low cost Building Material" to study the possibility of using humanhair as fibrein concrete. Tests were conducted on concrete with addition of HHF in various percentages i.e., 0%, 1%, 1.5%, 2%, 2.5% and 3% by weight of cement and results were compared with those of plain cement concrete of grade M20. There is an augmentation in the strength of cement by the expansion of human hair as fiber support which makes it appropriate for an elective added substance for cement to upgrade its mechanical properties. Hair fibre concrete can be used for construction in Andaman and Nicobar Islands were use of fibre in concrete is less cited due to lack of local vendors and higher market rates.

- S. Ahmed, F. Ghani and Md. Mahmudul Hasan (2011), published a paper on the use of Waste Human Hair as a Fibre Reinforcement in

Concrete" by addition of different percentage of human hair in concrete. There has been a significant increase in compressive strength. According to the test performed it is observed that there is remarkable increment in properties of concrete according to the percentages of hairs by weight of concrete. There was a general increment of 1 - 12% in the compressive strength of concrete and up to 5% in the flexural strength of substantial test examples by the expansion of hair strands in various amounts. Break arrangement and spread are a lot of decreased showing that HHF built up cement can have its applications in seismic safe developments.

1.1 Materials used

COLLECTION OF RAW MATERIALS

The stuff to be use in this study are

- Ordinary Portland cement(OPC) 53grade ACC Cement
- Mortal hair fibre mortal hair fibre collected from the taproom shop in the Srinagar quarter.
- These fibres are chapped into3.5 cm length and washed these fibres in the acetone for washing or polishing purposes.
- Water Collected from the original fresh water sources.
- Fine total Swash beach passing through4.75 mm sieve size.
- Coarse total Aggregate sizes of 20 mm.

CEMENT

Cement acts as a binding agent in concrete. Cement imparts strength to concrete. Ordinary Portland cement(OPC) of 53 grades conforming to IS 8112-1989 is used for disquisition.

Different test was carried out to determine their parcels as per Indian standard similar as specific graveness, normal thickness, original setting, final setting, fineness etc.

Fine Aggregates

Fine aggregate is a material such as sand, crushed stones, or crushed gravel passing through sieve 4.75 mm size. In Pampore Jammu and Kashmir locally available crushed stone dust is used as fine aggregate in the various concrete mixes due to non-availability of river sand at material testing lab. The properties of sand were determined by conducting tests as per IS: 2386. The result indicates that the sand conforms to Zone- II as per IS: 383-1970.

Coarse Aggregates

The material whose particles are of size as retained on 4.75mm IS sieve is termed as coarse aggregate. Coarse aggregate of 20 mm size were used. Crushed granite stones taken from material testing lab were used as coarse aggregate. The properties of coarse aggregate were determined by conducting tests as per IS: 2386(part-III).

RESEARCH METHODOLOGY

The stuff used are Ordinary Portland Cement, Fine total, Coarse total, water and mortal hair as fibre. For every one of the accoutrements employed essential tests were directed by the IS details.

TESTS ON FRESH CONCRETE

The following tests are to be conducted on fresh concrete;

1. Slump cone test

- Cement, sand and aggregate were mixed in dry state in the ratio 1:1.66: 2.87
- Adopted W/C ratio 0.5 calculated the quantity of water to be added. Water was added to dry ingredients and they were mixed well.
- The slump cone apparatus was cleaned and it was held firmly at the base.
- The mould was filled in three layers and was given 25 blows using a standard tamping rod.
- The mould was lifted vertically up carefully.
- After the subsidence of concrete .noted the slump corresponding to highest part of slumped concrete in mm.

2. Compaction factor test

- The weight of the empty cylinder, wl was noted.
- Fresh concrete of nominal mix with an initial W/C ratio equal to 0.5 was prepared.
- The two hopper A and B and cylinder were cleaned well and the bottom doors of hoppers were closed.
- The freshly prepared concrete was placed gently into the upper hopper and the bottom door was released, allowing it to fall into the lower hopper.
- The bottom door of the second hopper was also released, allowing the concrete to fall into the cylinder.
- The excess concrete over the cylinder was struck off using a trowel and the outside surface was cleaned.
- The weight of the cylinder, W2 was noted.
- Concrete was filled in the cylindrical mould in three layers and compacted by giving 25 blows using the standard tamping rod.
- The weight of the cylinder, W3 was noted.
- Then compaction factor is calculated using the formula, Compaction factor = (W2- W1/ (W3- W1).

1.2 TESTS

TESTS ON HARDEN CONCRETE

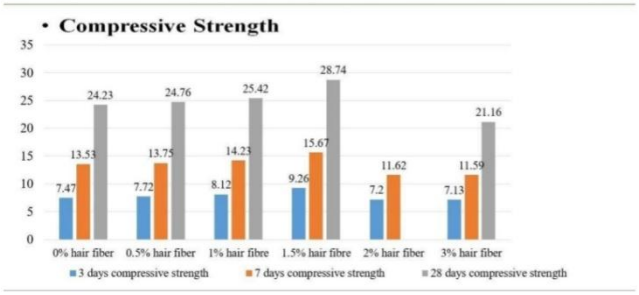
The following tests are to be conducted on hardened concrete;

1. Compressive strength test

Make specimens cubical in shape of size 150mm x 150mm x 150mm.

- Place it on the bearing surface of the compressive testing machine.
- Apply a uniform load till the specimen fails.
- Note down the maximum load and calculate the compressive strength.

S. No	For Days	Compressive Strength In N/mm2					
		Mix 1 0%	Mix 2 0.5%	Mix 3 1%	Mix 4 1.5%	Mix 5 2%	Mix 6 3%
1	3	7.47	7.72	8.12	9.26	7.20	7.13
2	7	13.53	13.75	14.23	15.67	11.62	11.59
3	28	24.23	24.76	25.42	28.74	-	21.16

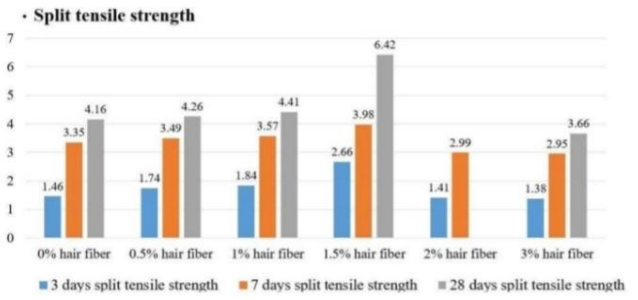


2. Split tensile strength

Cylinder specimen 150X300mm was prepared using concrete with w/c ratio 0.5. The test was done after 3 days, 7 days and 28 days of curing and immediately after removing off from water. The surface water was wiped off. A diametric line on the two ends of the specimen was drawn so that they were in the same axial plane. One of the pressed wood strips was put along the focal point of the lower plate. The example was put on the pressed wood strip and adjusted to such an extent that the lines set apart on the closures of the example were vertical and focused over the compressed wood strips. The subsequent pressed wood strip was put longwise on the chamber. The load is applied without shock and gradually increased at a steady rate until the specimen failed by splitting at the vertical axial plane. Note the load.

Table 5.7: Results of split tensile strength

S. No	For Days	Split tensile Strength In N/mm2					
		Mix 1 0%	Mix 2 0.5%	Mix 3 1%	Mix 4 1.5%	Mix 5 2%	Mix 6 3%
1	3	1.46	1.74	1.84	2.66	1.41	1.38
2	7	3.35	3.49	3.57	3.98	2.99	2.95
3	28	4.16	4.26	4.41	6.42	-	3.66



2. RESULTS

Compressive Strength

The compressive strength of concrete is determined by testing the cubes under compressive testing machine. The results of compressive strength are shown in the maximum compressive strength occurred at (Mix 4: 1.5% hair fiber) and it is nearer to the target strength.

The compressive strength of concrete is its ability to resist a crushing force. It is the ratio of load at failure to surface area of concrete specimen. The results from the compression test are in the form of the maximum load the cube can carry before it ultimately fails. The results of compressive strength test shows that the maximum compressive strength is obtained by adding 1.5% of human hair by weight of cement.

Split tensile strength

- Split tensile test was led for the chambers of 150mm dia and 300mm length. The got values are classified in Table-3, Compared to traditional substantial break width is for this fiber supported concrete. Splitting of specimens into two pieces can be controlled completely with this fiber.
- Maximum split tensile strength occurred at (Mix 4: 1.5% hair fiber) and it is nearer to the target strength.

DISCUSSIONS

It is observed that the strength of concrete is increased according to the percentages of hairs by weight of cement in concrete. Tests were carried out for 0%, 0.5%, 1%, 1.5%, 2% and 3%. It was found that M20 grade concrete with 1.5% HHF gives maximum compressive strength of 9.26, 15.67 and 28.74N/mm2 at curing periods of 3, 7 and 28 days respectively when compared with the plain cement concrete. Similarly there is an increase in split tensile strength also for 1.5% HHF. Beyond 1.5% there is a reduction in strength. The cracks were also reduced in concrete specimens with hair fibre when compared with plain concrete.

3. CONCLUSIONS

1. Natural hair waste can be effectively managed to be operated in fiber supported concrete constructions.

2. According to the test performed it's observed that there's remarkable addition in properties of concrete according to the probabilities of hairs by weight of cement in concrete.

3. The mortal hair fiber concrete has the high compressive strength varied with the ordinary Concrete.

4. More disunited pliantness was fulfilled with the expansion of the mortal hair in concrete. The strength has expanded when varied with that of the ordinary substantial illustration.

5. It's each around saw that the most extreme proliferation is seen in the expansion ofl.5 hair fiber, by weight of concrete, in every one of the composites.

6. Break arrangement and actualizing are a lot of lowered demonstrating the way that FRC can have its operations in seismic safe developments.

7. The expansion of mortal hairs to the substantial not just changes different parcels of substantial like severity, compressive strength yet also improves the limiting parcels, atomic breaking control and likewise supplements spalling inhibition.

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