

# Study of Human Hair Reinforced Cement Concrete

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**Abstract** - Human hair is a waste material that is determined in bountiful sum in day by day existence. it is a regular constituent in city squander streams and reasons ecological troubles as it's far a non-degradable waste. Fiber strengthened cement give great flexure strength less break improvement. Considering that concrete is frail in stress for that reason some estimates ought to be embraced to defeat this insufficiency. Human hair is by way of and massive solid in pressure; henceforth it thoroughly may be applied as a fiber fortification cloth. Human hair Fiber is a preference non-degradable problem to be had in riches and at unassuming cost. Hair moreover diminishes ecological issues. Likewise growth of human hair strands improves the coupling residences, miniature breaking manipulate, Imparts ductility, power and moreover builds expanding competition. The exploratory discoveries in our investigations might guide destiny exam towards the path for lengthy haul execution to expanding this price of powerful form of strands for use in number one packages. exam had been led on stable three-D shapes, chambers and mild emissions sizes with growth of various quotes of human hair fiber i.e., 0%, 0.5% 1%, 1.25%, 1.5% and 2% weight of concrete, best and coarse combination and results were contrasted and people of plain concrete cement of mid-variety grade. For each stage of human hair included stable, we make a exceptional cubes sample that were tried for their character mechanical homes at relieving instances of 7days, 14days and 28days. Best amount of human hair turned into gotten as 2% with the aid of weight of concrete for strength purpose and 1% human hair amount mix for most durable structure. That investigation encourages the more energizing to realise the human hair fiber fortified execution in concrete cement. In this paper flexure, tensile, water absorption, acid attack tests are performed.

**Key Words:** Flexure strength, Tensile strength, Water absorption, Durability, Environment.

## 1. INTRODUCTION

Human hair waste produced in large amount which can not be putrey and that waste are responsible for block the sewage flow and pollute environment. But human hair has a one good quality that is its tensile strength. So we use human hair as a reinforced fibre in concrete. Concrete has enough strength in compression but weak in tension. Tensile strength of concrete is around 10 percent of compressive strength of concrete hence it should be reinforced either with steel or different types of fibers for

increasing the tensile strength of concrete. Different types of fibre used in concrete. There are additional chance for use completely different material as fibers in concrete, human hair being one in every of them and thought of as a waste hairs collection causes a few natural issues; be that as it may, it very well may be conjointly utilized as fiber in cement. Fuse of human hairs to the solid improves solid properties, for example, flexure strength, tensile strength and holding the board along with obstruction from spalling at fortification and solid bond. Accordingly, human hairs which are in relative plenitude in behavior and are non-degradable, gives great alternative in fiber fortified cement. A retardant of non-uniform dissemination of hairs is visaged though exploitation them as filaments anyway it likewise can be settled by Electrostatically charging them. Hair acts like all elective fiber, and have a few advantages. Its high strength makes it satisfactory to utilize a copper wire with comparative breadth. Hair being a non-degradable issue is making partner degree ecological disadvantage in this manner its utilization as a fiber fortifying material would limit the issue. It is in bounty and at an extremely low cost. It fortifies the mortar and keeps it from spalling. Fake strands are synthetic filaments in which essential substance units made by compound blend. Normal strands are named hair like material which is acquired from trimming creature hair and plants. Manufactured strands can be created at low cast and in immense amount when contrasted with characteristic filaments. Normal strands can give a few advantages for attire, for example comfort and over their engineered partners and furthermore utilized for underlying applications, yet the generally with manufactured thermoset grid material that gives some natural advantages. The examination about human hair waste and its use was assessed by Gupta. Gupta saw that the employments of human hair in the huge number of zones which including agrarian, medication and mechanical [1]. Strands which are generally utilized in development industry are steel filaments, glass strands, engineered strands and normal filaments. Filaments having short length are blended in plain cement for improving its fragile conduct and conferring the flexibility. This new kind of cement having short discrete filaments spread toward all path is alluded as fiber strengthened cement (FRC). Strands can be diminished penetrability of concrete just as seeping of water. Filaments interlink and capture around the total particles and blending that liable for low functionality. Human hair is solid in pressure with the goal that it utilized as fiber strengthened material. As plain cement is feeble in pressure, hence, number of

methods are being created to defeat this inadequacy. Moreover, these strategies incorporates utilizing changed materials like normal fiber for example creature hair, human hair and so on which can increment pliable conduct and gives in flexural conduct of cement. Economical cement includes utilization of such materials which satisfy both requirements for example improve strength and material ought to be accessible in neighborhood market at reasonable sum. This is the explanation hair are utilized in this examination as fiber. Hairs are considered as waste and result in the vast majority of the societies and are unloaded in outdoors. Some place these dumps are left transparently for its degraation, at different spots hair burnet openly which creates natural contamination by making poisonous gases. To save the climate from its debasement by using the waste stuff (human hair) and to improve the pliable behaviour of cement are the primary targets of this exploration. In this paper we find out tensile strength, flexure strength and various important factor. In this current paper the test study, human hair strands are Incorporated into concrete at substance of 0, 0.5, 1, 1.25, 1.5 and 2% by weight of concrete. These examples made of human hair fiber strengthened cement are tried at 7, 14 and 28days and the change in mechanical properties when contrasted with plain concrete cement is noticed.

**2. Material Used**

Ordinary portland concrete of grade43 with starting setting time of 30minutes and last setting time of 460minutes utilized. Sand used as a fine aggregate which passing through 2.36mm IS sieve is taken. 20mm angular shape coarse aggregate are used. Locally available human hair are used in the analysis. It is collected from Barabanki salon. Water is generally used for mixing and curing of concrete.

**Table-1:** Properties of human hair

Properties	Value
Length of hair fibre	12 to 65mm
Diameter of hair	80 to110 μm
Aspect ratio	110 to 680
Tensile Strength	290
Strain	45%
Specific gravity	2.57

**3. METHODOLOGY**

In this paper we findings, flexure strength, tensile strength, water absorptions and acid attack tests are performed. For carrying out this experimentation concrete cubes of size (15cm x 15cm x 15cm) were created having grades M20 for plain cement concrete and for fibre reinforced concrete using human hairs. A set 3 cubes was prepared and was tested after a curing for 7, 14 and 28

days. For preparing the concrete cubes having human hair as a fibre, hairs were utilized in varying percentage by weight of cement replacing the quantity of cement. The hairs which are used for preparing the specimen concrete cubes were collected from beauty salons then were segregated from the opposite waste and were finally washed with water followed by proper drying under the sun. After that the dried and clean hairs were further segregated based on the length, color and texture of hairs so as to have a uniform distribution of hairs in concrete. The main consideration within the entire experimentation was to combine the dry materials properly before adding any amount of water so on make an efficient mix design. The hairs were weighed by using sensitive weighing machine. After adding water and mixing properly the moulds were kept on a vibrating table to initiate vibrations and to make sure that placing of concrete in the mould is done properly layer by layer so as to avoid any voids or air gaps between the aggregates and the binding material and to have a proper placing of concrete till it is completely filled so on reduce any entry of air bubbles or voids inside the concrete cubes. Finally the moulds were removed from the vibration plate and were kept within the lab with none disturbance for next 24 hours. After that the moulds were removed and the cubes were put into the water tank for different curing durations of 7, 14 and 28days.

**4. RESULTS AND DISCUSSION**

**4.1 FLEXURE STRENGTH TEST**

Flexure strength test was done according to IS 516-1959 specifications. Ordinary solid shafts and human hair fortified solid light emission 15cm×15cm×70cm are tried utilizing a testing machine. The sample is just upheld on 2 rollers the machine which are 60cm separated with a bearing of 5cm from each end support. Load is applied at constant rate. The load is increased till fracture occure and specimen fails.

**Table -2:** Flexure strength test

S.NO.	Percentage of hair	Flexure strength 3 Days (N/mm <sup>2</sup> )	Flexure strength 7 Days (N/mm <sup>2</sup> )	Flexure strength 28 Days (N/mm <sup>2</sup> )
1	0	1.38	2.26	3.17
2	0.5	1.56	2.39	3.29
3	1	1.69	2.58	3.43
4	1.25	1.74	2.63	3.54
5	1.5	1.81	2.69	3.76
6	2	2.12	2.91	4.38

#### 4.2 SPLIT TENSILE TEST

Tensile strength of concrete is around 10% of its compressive strength. For increasing the tensile strength of concrete we use hair waste as fibre reinforcement. Because tensile strength of hair is good. For checking the tensile strength we do test.

**Table -3:** Split tensile test

S.NO.	% of hair	Tensile strength 3Days (N/mm <sup>2</sup> )	Tensile strength 7Days (N/mm <sup>2</sup> )	Tensile strength 28Days (N/mm <sup>2</sup> )
1	0	1.29	2.20	3.18
2	0.5	1.56	2.31	3.28
3	1	1.61	2.39	3.46
4	1.25	1.68	2.52	3.54
5	1.5	1.79	2.63	3.58
6	2	1.91	2.84	3.64

#### 4.3 WATER ABSORPTION TEST

This test is done for knowing the sample how much durable. Because durability of concrete is inversely proportion to its water absorption capacity. The level of water consumed by the solid builds, the strength of the solid gets diminished. From the tests led, it is seen that there is a lessening in measure of water ingested while consolidating hair as support in cement. In this test blocks are totally drenched in water at room temperature for 1day. Squares will at that point be eliminated from the water and permitted to deplete briefly by putting them on a 10mm or coarser wire network, obvious surface water being taken out with a moist fabric, the immersed and surface dry squares promptly gauged. In the wake of gauging all squares will be dried in a ventilated stove.

**Table -3:** Water absorption test

S.NO.	Percentage of hair	Dry weight (kg)	Wet weight (kg)	Percentage absorption
1	0	8.235	8.589	4.29
2	0.5	8.046	8.275	2.84
3	1	8.122	8.307	2.27
4	1.25	8.344	8.542	2.37
5	1.5	8.357	8.566	2.50
6	2	8.374	8.603	2.73

#### 4.4 ACID ATTACK TEST

The cube was casted by concrete and human reinforced fibre are taken for this test after 28days of water curing, the sample were taken out from the relieving tank and permitted to dry for 1day and the heaviness of cube

shapes were taken. At that point solid blocks are inundated in corrosive water for 28 days. After 28days of submersion, the solid shapes were removed from corrosive water. At that point, the example was tried for compressive strength. The opposition of cement to corrosive assault was found by the rate deficiency of weight of example and the rate loss of compressive strength on drenching solid blocks in corrosive water.

**Table -4:** Acid attack test

S.NO.	Percentage hair	Weight loss (percentage)	Strength loss (percentage)
1	0	1.08	15
2	0.5	1.19	13.6
3	1	1.16	13.1
4	1.25	1.19	13.4
5	1.5	1.24	13.6
6	2	1.23	13.9

#### 5. CONCLUSIONS

Human hair waste is used in concrete of different percentage by weight of cement in concrete. Some important test were performed on cube that is made by the help of hair fibre reinforced. Out of five sample of hair reinforced concrete, namely 0%,0.5%,1%,1.25% and 2%, the optimum percent of hair mix of the weight of cement is to be 2% for peak value of compressive strength. Adding 2% of hair fibre by weight of cement the flexure and tensile strength were increased by 38.17 % and 14.46 % respectively at 28days. After 28 days minimum water absorption in cube when adding 1% of hair fibre. Hair fibre improve the strength and also improve its durability.

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