

**“USE OF HUMAN HAIR AS FIBRE REINFORCEMENT IN CONCRETE”**

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**ABSTRACT:** *Since ancient times, many researches were carried out to increase the mechanical and physical properties of concrete. As technology is getting advance day by day due to commercialization, new findings are being made to explore the possibility for increasing the compressive strength of the concrete. Fibre reinforce is one of the research among those which offers a convenient practical and economical method for overcoming micro-cracks and similar types of deficiencies. It also reduced greater impact abrasion and shatter resistance in concrete. As human hair offer resistance to tension and it is also found in abundance in nature human hair Fibre is an alternative non-degradable matter and at cheap cost, therefore it can be used as Fibre reinforcement in concrete. Experiment were conducted on concrete cubes with addition of various percentage of human hair fibre 0%, 1%, and 1.5% by weight of cement, fine and coarse aggregate result were compare with those of plane cement concrete of M20 and M 25 grade and the cubes were tested for their respective mechanical properties at curing period 7, 14, and 28 days the main result of these research work will lead to the finding of the fact that whether compressive strength increases or not by using human hair as a fibre reinforcement material in concrete.*

## 1. INTRODUCTION

Every civil engineer knew that what is concrete and where it is used it is a common term which means a mixture of materials generally used in the construction work. compressive strength is three primary measure parameter of concrete it depends upon the quality and quantity of material used to prepare the the concrete such as cement, fine aggregate and coarse aggregate fibre reinforced concrete is concrete containing fibrous material which increase its structural integrity, it contain short discrete Fibres that are uniformly distributed and randomly oriented the various fibre which can be used as the fibre reinforced material are glass fibre, synthetic fibre, steel fibre, and natural Fibre a fibre is a small piece of reinforcing material possessing certain characteristics properties addition of fibre to concrete influences its mechanical properties which significantly depend on the type, length and percentage of fibre. human

hair can be used as Fibre in fibre reinforced concrete as well owing to the various reason it imparts higher tensile strength which can be equal to the tensile strength of copper wire having same diameter ( Jain d and Kothari A .25<sup>th</sup> January 2012 ) human hair fibre has an elastic characteristic and it may undergo moderate starching either wet or dry when dry, the hair thread may be stretch 20-30% of its length and in contact with water, and these may reach up to 50% ( Nila V, Rajjan October 2015 ). Human hair not only offers high compressive strength as well as reduced the micro cracking and increasing structural stability

## 2. ADVANTAGES

- Fibre reinforced concrete is used in structure where corrosion is to be avoided at the maximum

- It reduced internal forces by locking microscopic cracks from forming within the concrete.
- It have been proven that fibre reinforced concrete improve the some mechanical properties such as compressive strength flexural strength , toughness, ductility , impact resistance it is better suited to minimize cavitations in structure where high velocity flows are encountered.

### 3. DISADVANTAGES

- The fibre have to uniformly this is found to be a time consuming and difficult process.
- If these limitations have been overcome by new and effective methods of fabrication, fibre reinforced concrete is found to be more acceptable for common concreting work.

### 4. WHY HUMAN HAIR IS USED AS A FIBRE?

- human hair is generally strong in tension hence it can be used as a fibre reinforcement material
- it is consider as a waste material
- it is commonly found in municipal waste streams which creates environmental problems
- it is also available in abundance and at a very low cost
- human hair Fibres enhances the binding properties , micro cracking control and also increases swelling resistance

### 5. HAIR TREATMENT

- The hairs are collected from the saloon shop for the preparation of concrete cubes, it needs treatment before to be added in the concrete mixture there are following steps are to be carried out.
- **Separating** – it is depending on the source of collected hair, if it contains any waste this has to be removed.
- **Drying** – after separating, the hair is then dried under sun and then it can be stored without any concern for decay or odour.
- **Sorting** – the hair is sorted according to length , color and quality.

### 6. MATERIAL TO BE USED

**Cement** – ordinary Portland cement of 53 grades is used Cement is a greenish grey color of powder which is used to make concrete

**Sand** – sand is naturally occurring granular material composed of finally divided rock and Mineral particle.

The sand was sieved first through 4.75 mm sieve to remove any particles greater than 4.75 mm and was then washed to remove dust.

**Aggregate** - the aggregate are made free from dust before being used in the concrete .Its specific gravity is 2.707

**Human hair** – human hair fibre collected from the salon shop and the hair should be free from Dust particle and other

matter, approximately uniform length of hair should be used to make the Concrete mix.

### 7. COMPRESSION TEST

Compression testing is a very common testing method that is used to establish the compressive force or crushed resistance of a material. It is the ratio of load at failure to surface area of concrete specimen. Compressive strength test is conducted on hardened concrete. The compressive test is carried out on specimen cubical in shape of the standard size 150\*150\*150 mm. The rate of load is taken as constant for each concrete cube tested. While applying load a great care is to be taken of that rate is neither too fast and not too slow, it should be at a constant rate with the help of load rate layer. The result from the compressive test are in the form of the maximum load the cube can carry before it fails the compression strength can be found by dividing load by the area of test specimen.



### 8. METHODOLOGY

This experiment is compared with the strength parameter of concrete human hair is added to plain cement concrete in 0 , 1 and 1.5 % of weight of cement and is compared for 7 , 14 and 28 days curing period. The compressive test are conducted on concrete specimen to analyze its mechanical properties In this study we are planned to make concrete cube with various proportion human hair such as Fibre 1% 1.5% of and its compare with plain cement concrete. The experiment was divided into two major proportion first one is making concrete with M20 and M25 grade having 3 or cubes for each grade and after completion of this concrete cubes were casted with hair as a Fibre taken 1% and 1.5 % by weight of cement with m 20 and m25 having three cubes for each grade and for the same curing period the hairs are collected from the saloon for the proportion of concrete cubes and it is needs treatment before to be added in the concrete

specimens such as separating, washing, drying and sorting the water cement ratio was taken as 0.5 by weight of cement total 18 cubes for all the three mixtures ( 0 %), ( 1%), and ( 1.5 %) it was make sure that the addition of hairs in the mixtures is uniformly done, water was not added till the time the whole mixture is fully integrated with each other ( cement, sand, aggregate ) mixing was thoroughly done before water being poured in and after that water was added suitably and mixing was done again to prepare the concrete mixture uniformly wt and ready for placing. Before placing of concrete in a mould oil must be applied to the inner surface of the mould to easily removal of concrete cube after harden. The cast iron moulds are used to prepare specimen of size 150 \*150 \*150 mm during the placing of concrete placed concrete in three layers in the mould it is properly compacted each layer with the tamping road with not less than 25 strokes per layer to remove air bubbles, voids inside the concrete cubes and after these the moulds were put inside the lab at a suitable place, after 24 hrs the specimens are removed from the mould are immediately submerged in clean fresh water after completion of curing period (7 days 14 days and 28 days ) specimens are tested under the load in a compression testing machine for both types of concrete and carry out the comparison and analysis. The result of compression test is in the form of maximum load that cube can be carry before it ultimately fails. The compressive strength is calculated by dividing the maximum load by the contact area of specimen

$$\sigma = \frac{P}{A}$$

Where  $\sigma$  = maximum compressive strength

P = maximum load

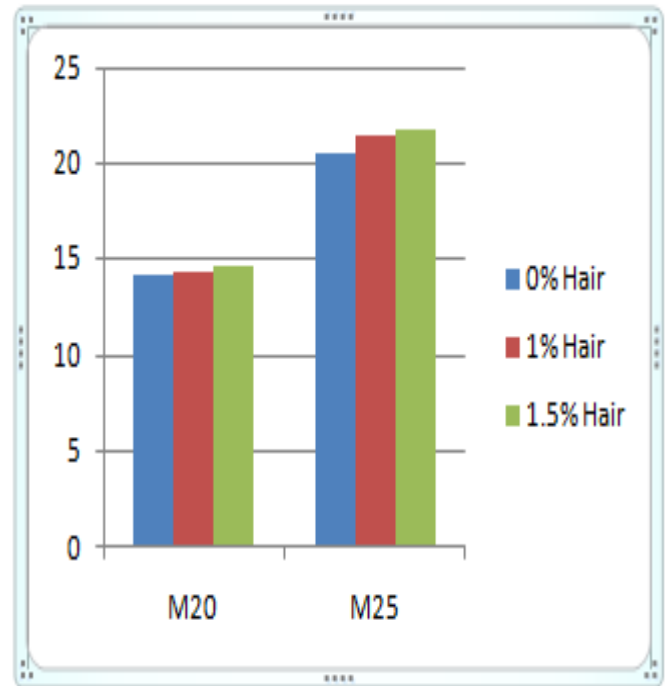
A = contact area of specimen

### 9. RESULT OF COMPRESSION TEST OF SPECIMEN

For 7 days curing period

Concrete grade	% of hair	Maximum load taken (KN)	Compressive strength (N/mm <sup>2</sup> )
M 20	0%	318.05	14.13
M 20	1%	324.48	14.42
M 20	1.5%	329.18	14.63

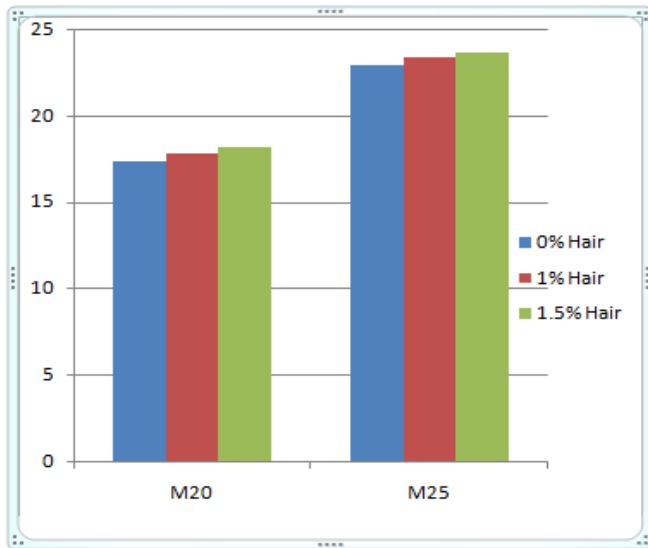
Concrete grade	% of hair	Maximum load taken (KN)	Compressive strength (N/mm <sup>2</sup> )
M 25	0%	463.17	20.58
M 25	1%	482.38	21.43
M 25	1.5%	490.15	21.78



For 14 days of curing

Concrete grade	% of hair	Maximum load taken (KN)	Compressive strength (N/mm <sup>2</sup> )
M 20	0%	389.71	17.32
M 20	1%	393.21	17.79
M 20	1.5%	399.45	18.15

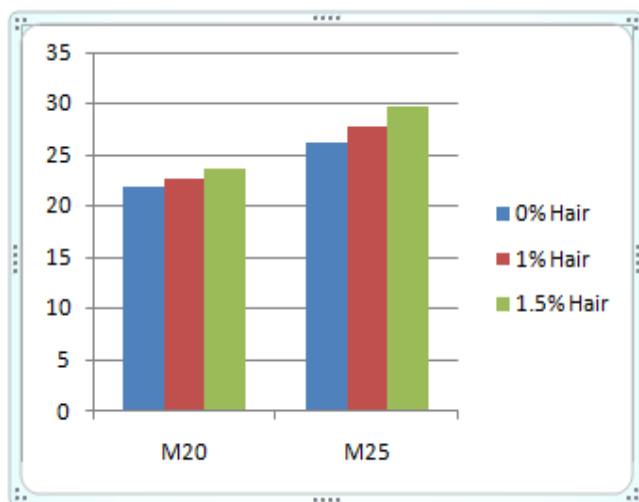
Concrete grade	% of hair	Maximum load taken (KN)	Compressive strength (N/mm <sup>2</sup> )
M 25	0%	515.52	22.91
M 25	1%	525.39	23.35
M 25	1.5%	531.17	23.60



For 28 day curing period

Concrete grade	% of hair	Maximum load taken (KN)	Compressive strength (n/mm <sup>2</sup> )
M 20	0%	491.38	21.83
M 20	1%	512.17	22.76
M 20	1.5%	532.19	23.65

Concrete grade	% of hair	Maximum load taken (KN)	Compressive strength (n/mm <sup>2</sup> )
M 25	0%	590.61	26.26
M 25	1%	623.17	27.69
M 25	1.5%	667.77	29.67



### 10. ANALYSIS OF RESULT

- Human hair has a various properties which made it suitable to be used as fibre reinforcement in concrete. our result show that there is a remarkable increment in the properties of concrete as well as increase the compressive strength to the percentage of hair by weight of concrete
- It was found that, there is an increase of 2.05% of compressive strength when M20 concrete with 1% hair is compare with the plane cement concrete for a curing period 7 days. when compressive strength of M20 concrete with 1.5% hair is compared with the plane cement concrete , it was found that there is an increase of 3.53% of compressive strength for a curing period of 7 days .
- When compressive strength of M25 concrete with 1% hair is compared with the plane cement concrete, it was found that there is an increase of 4.13% of compressive strength for a curing period of 7 days. when compressive strength of M25 concrete with 1.5% hair is compared with the plane cement concrete , it was found that there is an increase of 5.83% of compressive strength for a curing period of 7 days
- When compressive strength of M20 concrete with 1% hair is compared with the plane cement concrete, it was found that there is an increase of 2.71% of compressive strength for a curing period of 14 days. when compressive strength of M20 concrete with 1.5% hair is compared with the plane cement concrete , it was found that there is an increase of 4.79% of compressive strength for a curing period of 14 days .
- When compressive strength of M25 concrete with 1% hair is compared with the plane cement concrete, it was found that there is an increase of 1.92% of compressive strength for a curing period of 14 days. when compressive strength of M25 concrete with 1.5% hair is compared with the plane cement concrete , it was found that there is an increase of 3.01% of compressive strength for a curing period of 14 days .
- When compressive strength of M20 concrete with 1% hair is compared with the plane cement concrete, it was found that there is an increase of 4.26% of compressive strength for a curing period of 28 days. when compressive strength of M20 concrete with 1.5% hair is compared with the plane cement concrete , it was found that there is an increase of 8.33% of compressive strength for a curing period of 28days
- When compressive strength of M25 concrete with 1% hair is compared with the plane cement concrete, it was found that there is an increase of 5.52% of compressive strength for a curing period of 28 days. when compressive strength of M25 concrete with 1.5% hair is compared with the plane cement concrete , it was found that there is an increase of 10.78% of compressive strength for a curing period of 28 days.

### 11. FUTURE SCOPE

Used of human hair as a fibre reinforcement in concrete widens the the door for further research in the construction field

- The study of admixtures and super-plasticizers which could distribute the hair without affecting the properties of concrete
- applications of hair fibre reinforced concrete in the seismic resistance structure
- the used of human hair as a nano materials in the advanced nano technology in concrete.

## 12. CONCLUSION

According to the test perform it is observed that there is remarkable increment in properties of concrete. Compressive strength of the human hair specimen are increased as compared to plane cement concrete . It is well observed that the maximum increase in the addition of 1.5 % of hair fibre by weight of cement as compare to 1% hair by weight of cement. It modify the various properties of concrete like compressive strength , developed tensile strength and also enhance the binding properties and reduced to micro cracking to the great extent

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