

# Hair as a Fiber Reinforcement Concrete – A Review

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**Abstract:** In the "Research Review" I am going to discuss about "Hair as a Fiber Reinforcement Concrete". Now a days various researches are done on the hair to be used as a fiber reinforcement in the design of various concrete mix. Human hair has good tensile strength, available at very low cost, and a non-degradable matter, due to these characteristics hair can be used in as fiber reinforcing material in concrete.

**Keywords:** Reinforcement concrete.

## 1. Introduction

Fiber Reinforcement concrete is concrete which contains fibrous material that increases structural properties of the concrete. Fiber is a reinforcing material with certain characteristics and properties. This can be circular or flat and is described by the parameter called "ASPECT RATIO" (Ratio of length to its diameter, varying from 30 to 150).

Fibers are used in concrete to control cracking in the concrete due to the plastic and drying shrinkage. These fibers are mostly used in flooring and pavements, but can be considered in construction of beams, foundations etc.

Fiber Reinforcement increase the tensile strength, reduces air voids, increases durability, reduces permeability of concrete thus reduces bleeding of water from the mix

Fiber such as a human hair can also be used due to its various following properties,

- 1) Hair is a non degradable matter due to which it is creating environmental problem, if it is being used as a fibre reinforcement, the demand of hair will increase and we can overcome this problem.
- 2) The tensile strength of hair is equal to the cooper wire (If both compared with similar diameter).
- 3) Hair reinforces the mortar and prevents segregation and bleeding.
- 4) As hair on earth is present in large quantity due to which its cost is very low.

In this experiment, the human hair is used as fiber reinforcement in concrete at the content of 0.5%, 1.0%, 1.5% to the weight of cement. The specimen of beams, cubes and cylinder were casted with this concrete mix with hair as fiber reinforcement.

Various basic tests were performed on the specimens and material used to cast the specimen. They were cured properly

for 28 days to evaluate various properties of concrete.

These specimens were tested at 3, 7 and 28 days respectively and the change in physical and mechanical properties of concrete with hair as fiber reinforcement were observed and were compared with plain cement concrete (PCC) of the same grade.

## 2. Literature Review

This section includes the background researches, information and issues on the topic hair as a fiber reinforcement from various authors published before the present research work and to focus the result of current research.

A paper was published by "Sinan Abdulkhaleq Yaseen" An Experimental investigation on the mechanical properties of Natural Fiber Reinforced Mortar in 2003. Dr. Sinan published the "Use of Human Hair Fiber" as Reinforcement fiber in concrete. Various tests such as splitting tensile strength, compressive strength, flexural strength, and load deflection (w/c ratio 0.6 and 0.7) were carried out to study the influence of fiber content.

Another paper was published by Susmita Antony, Neena Rose Davis, Riya Babu M. According to them it was observed that, there is remarkable increment in mechanical properties of concrete according to %age of hairs used to the weight of concrete. Various tests were performed by them to study increase in compressive strength of concrete. An average overall increase of upto 5% in flexural strength and 1-12% in compressive strength of concrete test specimen due to the addition of different quantities of human hair. The maximum increase was observed in the addition of 2% of hair fiber by weight of concrete in all mixes.

## 3. Methodology

In this experimental study mix, I Gurkeerat Singh is going to make concrete with fiber reinforcement with different proportion of 0.5%, 1%, 1.5% to the weight of cement. Control mix (Ordinary Portland Cement) is taken with 0% fiber.

### A. The collection of the raw material

The material used in experimental study is enlisted below,

- 1) OPC (ordinary Portland cement): 53 grade ACC concrete cement

- 2) Human Hair: Human hairs to be used as fiber were collected from saloon shop in Muktsar District. These human hair fibers were cut down 3 cm in length and were washed with acetone which is used for polishing and washing purpose.
- 3) Fine Aggregate: Fine Aggregate is a sand which passes through the sieve size 4.75mm.
- 4) Coarse Aggregate: Coarse aggregate of approx. 20mm in size were collected.
- 5) Water: Underground water which is fresh source of water was collected.

For the Raw material collected various tests were conducted as specified by IS CODE.

**B. Test results of materials**

**1) Test result of cement**

- \* Fineness of cement = 7.16%
- \* Specific gravity of cement = 3.190
- \* Normal consistency of cement = 31%
- \* Initial setting time of cement = 30 min
- \* Final setting time of cement = 600 min

**2) Test result of coarse aggregate**

- \* Sieve analysis = Table 2 (IS 383 - 1970)
- \* Specific gravity of coarse aggregate = 2.707
- \* Water absorption = 1.689

**3) Test result for fine aggregate**

- \* Seive Analysis = Table 1
- \* Specific gravity = 2.517
- \* Water absorption = 0.2

**4) Test result of water**

- \* Ph of water = 7.5
- \* Hardness = 200
- \* TDS = 300

**4. Experimental Work**

**A. Mixes**

Four mix were planned for cement concrete with %age of human with 0%, 0.5%, 1%, 1.5% to the weight of the cement. And length of human hair 3 cm was reinforced in all these four mix.

One Plain Concrete with zero value (0%) was taken as control mix. For each mix 3 cubes 150\*150\*150mm size and cylinder of 150mm and 400mm length and 3 beams of 700\*150\*1500mm were casted.

*Mix proportions:*

As per, M20 Grade (IS 10262- 2009)

Material	water	Cement	Fine Aggregate	Coarse Aggregate
In Kg/m <sup>3</sup>	186	294	724.845	1173.949
Ratio	0.5	1	2.466	3.993

Casting of the specimen as per control mix design (0% Fiber).

In all these mixes the human hair fiber varies in the percentage of 0%, 0.5%, 1%, 1.5% to the weight of cement used

in concrete mix. W/C ratio 0.5.

Total 12 cubes, 12 cylinder, 12 beams for all the 4 mixes including 0% fiber control mix.

- Mix 1 - 0%
- Mix 2 - 0.5%
- Mix 3 - 1%
- Mix4 - 1.5%

**B. Workability**

To determine the workability tests were conducted as below

- 1) Slump cone test
- 2) Compaction factor test

**C. Tests**

For hardening properties of concrete, the tests conducted on specimen on 3,7 and 28 days respectively are enlisted below,

- 1) Compressive Strength Test (3 cubes)
- 2) Split Tensile Strength Test (3 cylinders)
- 3) Flexural Strength Test (3 beams)

**5. Result**

**A. Workability**

It was observed that there is decrease in workability of human hair fiber reinforced concrete as compared to control mix with 0% hair fiber

Workability result of 4 mixes is as below,

S.no.	Mix No.	Slump value(cm).	Compaction Factor
1.	1	5	0.9
2.	2	6	0.92
3.	3	6	0.93
4.	4	4	0.95

**B. Compressive strength**

To determine compressive strength of concrete cubes are tested under compressive testing machine. The result from the compressive testing machine are as below,

S.no.	No. of days	Mix1	Mix2	Mix3	Mix4
1.	3	6.36	6.61	7.01	7.15
2.	7	12.42	12.63	13.12	13.46
3.	28	24.32	24.64	25.30	25.62

**6. Conclusion**

This paper presented an overview on hair as a fiber reinforcement concrete.

**References**

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