Experimental Investigation on Human Hair Fiber Based Concrete and Normal Concrete

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Abstract – Concrete as one of the most widely used building material. It is composed of three main elements there are cement, sand and fillers in which they are bonded together by cement and formed concrete that is in fact a man-made stone. It compressive strength is acceptable and tensile strength is very low (about ten percentage of compressive strength).

Human hair is strong in tension and can be used as a fiber reinforcement material. Hair fiber is an alternate non-degradable matter which is available in abundance and at a very cheap cost. In this work 0%, 2%, 6%, 8%, 10% hair fibers were added and as a result it increases the strength of the mixture thus making it a better material. Adding of both cement and human hair to reinforcement concrete in M20 Grade cement improves the load bearing capacity of a mixture and the required compressive strength is attained.

Index Terms – Concrete, Fiber, Human Hair.

1. INTRODUCTION

Concrete as one of the most widely used building material. It is composed of three main elements there are cement, sand and fillers in which they are bonded together by cement and formed concrete that is in fact a man-made stone. It compressive strength is acceptable and tensile strength is very low (about ten percentage of compressive strength). This weakness has plumbing problems, including concrete shrinkage and cracking (which is caused by shrinkage). Shrinkage of concrete depends on too many factors including the ingredients, temperature and relative humidity of concrete, concrete age, size and structure. In fresh concrete due to shrinkage concrete dimension has changed and created cracks and these cracks in concrete increases permeability, loss of concrete surface, reinforced corrosion and reduced mechanical properties. The aim of present work is to control the shrinkage parameters by introducing the hair fibers into the concrete. Therefore, concrete with 0, 2, 4, 6,8,10 by weight percentage of hair fibers with lengths of 15mm were prepared for experimental work.

2. LITERATURE REVIEW

Jain D. and Kothari A. Concluded that fiber reinforced concrete can offer a convenient, practical and economical method for overcoming micro-cracks and similar type of deficiencies. Experiments were conducted on concrete beams and cubes with various percentages of human hair fiber i.e. 0%, 1%, 1.5%, 2%, 2.5%, 3% by weight of cement.

Yadollah Batebi et al., concluded that basically most cement based mixtures are likely shrinking. Use of fiber is not a new idea in this case. Previously, there was some evidence that the horse hair, straw and cotton fiber were used in mud and mortars in ancient times. Then, utilizing these fibers in concrete mixtures may increases concrete workability and decreases shrinkage cracks.

Tomas U. Ganiron Jr. studied the effect of human hair additives in compressive strength of asphalt cement mixtures as potential binder in road pavement. Human hair is strong in tension and can be used as a fiber reinforced material.

3. EXPERIMENTAL INVESTIGATION

Cement: 53 Grade of cement confirming to Indian standard was used in this work. Specific gravity value 3.15

Fine Aggregate

Fine aggregate confirming to zone-II was used in this work. The specific gravity of sand was found to be 2.36mm, Fineness Modulus was found to be 2.95

Coarse Aggregate

The specific gravity of coarse aggregate was found to be 2.95

Water Locally available water without harmful substance was used in this work

Hair Fiber: Locally available Hair fiber from saloons was used. Percentage of replacement varied from 0 to 10%

Mix Design

Grade of concrete: M_{20}

Mix Proportion

Mix proportion are shown in Table 1

Table:1 MIX PROPORTION

	Cement	Fine aggregate	Coarse aggregate
For $1m^3$	383	546	1187
RATIO	1	1.42	3.09

Properties of Fresh Concrete

Workability test

The concrete slump test is an empirical test that measures the workability of fresh concrete. More specifically, it measures the consistency of the concrete in that specific batch. This test is performed to check the consistency of freshly made concrete. Slump values are shown in the table 2

Table:2 value of slump

Grade	w/c ratio	Initial height (mm)	Final height (mm)	Slump value
M_{20}	0.5	300	269	31

4. TESTING OF SPECIMEN

COMPRESSION STRENGTH TEST

Concrete cube of size 150mm was cast as per Indian standard and curing was done for 7days and 28 days respectively and the results are shown in Fig 1 and 2.

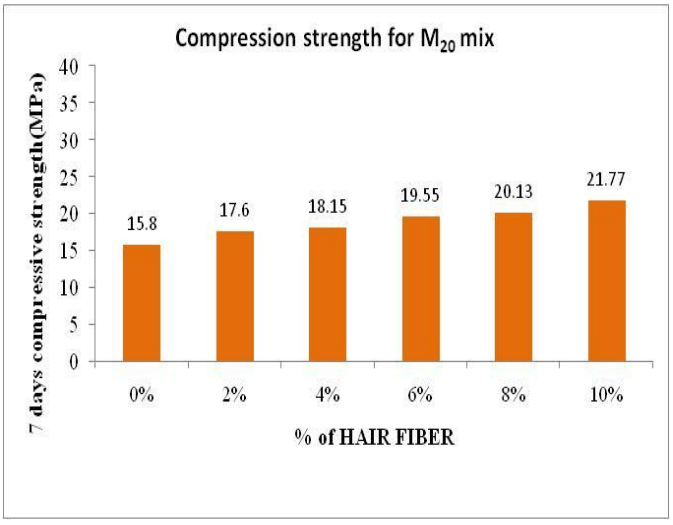

Figure 1: Compressive strength of concrete cubes after 7 days curing

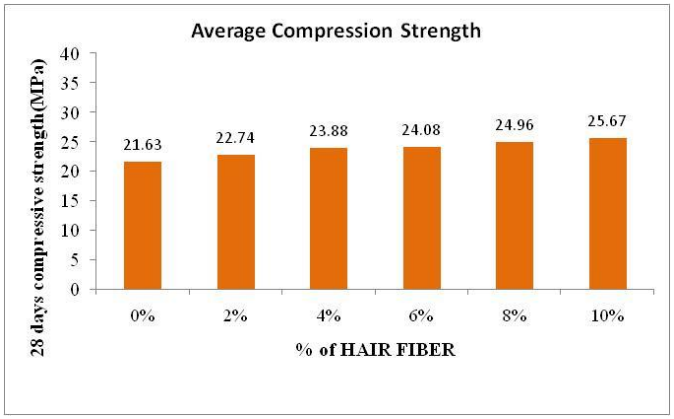

Figure 2 Compressive strength of concrete cubes after 28 days curing

Tensile strength of cylinder

The tensile strength is one of the basic and important properties of the concrete. The concrete is not usually expected to resist the direct tension because of its low tensile strength and brittle nature. Cylinder of size 150mm dia and 300height is casted and cured for 7days and 28 days respectively. The split tensile strength results are shown in figure 2 and 3 respectively.

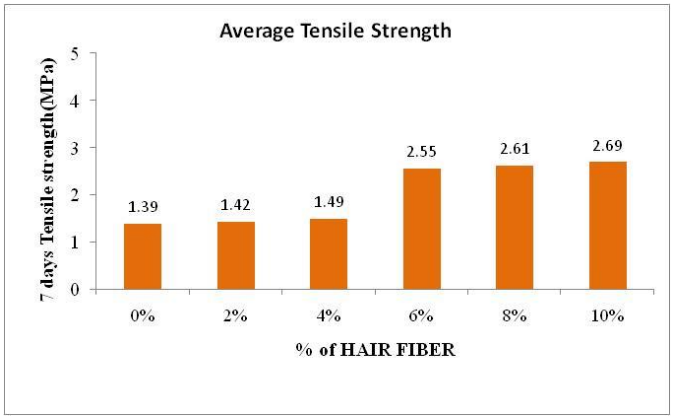

Figure 3: Tensile strength of concrete cylinder after 7 days curing

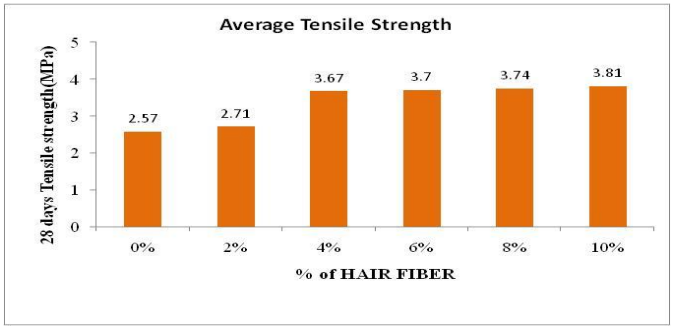

Figure 4: Tensile strength of concrete cylinder after 28 days curing

5. RESULTS ON CONCRETE SPECIMEN

The hair fiber concrete was designed for M20 grade concrete as per Indian standard codes and specimens were casted and tested after 7 days and 28 days curing ,the test results indicates that the admixture of hair fiber in concrete increases the compressive strength and tensile strength of the concrete. And it is found that the hair fiber can be added in concrete up to 10%.

6. CONCLUSION

The wastage of human hair from saloons and temples can be reused properly and can be used as a fiber material. By using this fiber cracks can be prevented. By preventing the cracks can able to increase the compression strength of the concrete and also increase the tensile strength of the concrete. By this way recycled the waste and make waste as useful thing.

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 in concrete. When M-20 concrete with 0,2,4,6,8,10 percentage of hair is compared with the plain cement concrete, it is found that there is an increase of compressive strength and in tensile strength. For each percentage the compression strength and tensile strength is increased. Finally it is concluded that 10% addition gives more compressive strength and tensile strength compared to other composition and 2% to 10% gradually increases strength when compared to conventional concrete.

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