Behaviour of Concrete by Using Human Hair

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Abstract— Fibre reinforced concrete can offer a convenient, practical and economical method for overcoming micro-cracks and similar type of deficiencies. Since concrete is weak in tension hence some measures must be adopted to overcome this deficiency. Human hair is strong in tension; hence it can be used as a fibre reinforcement material. Hair Fibre (HF) an alternate non-degradable matter is available in abundance and at a very cheap cost. It also creates environmental problem for its decompositions. Present studies has been undertaken to study the effect of human hair on plain cement concrete on the basis of its compressive, crushing, flexural strength and cracking control to economies concrete and to reduce environmental problems.Basically most of cement based mixtures are likely shrinking. Use of fibres is not a new idea in thiscase. Previously, there were some evidences that horse hair, straw and cotton fibres were used in mud and mortars in ancient times. Then, utilizing these fibres in concrete mixture may increase concrete workability and decrease shrinkage cracks. Due to Nano cross-section of hair and its proper tensile strength this project investigates its application to reduce the shrinkage of concrete mixtures.Experiments were conducted on concrete beams and cubes with various percentages of human hair fibre i.e. 0%, 1%, and 2%, by weight of cement and the length of the fibres in each case varied between 15 and 60 mm. For each combination of proportions of concrete, the three cubes are tested for their mechanical properties. By testing of cubes and beams we found that there is an increment in the various properties and strength of concrete by the addition of human hair as fibre reinforcement.

Index Terms— Human Hair, Workability, Shrinkage, Flexural strength.

I. INTRODUCTION

Concrete is a composite material containing hydraulic cement, water, coarseaggregate and fine aggregate. The resulting material is a stone like structure which is formed by the chemical reaction of the cement and water. This stone like Material is a brittle material which is strong in compression but very weak in tension. This weakness in the concrete makes it to crack under small loads, at the tensile end. These cracks gradually propagate to the compression end of the member and finally, the member breaks. The formation of cracks in the concrete may also occur due to the drying -shrinkage. These cracks are basically micro cracks. These cracks increase in size and magnitude as the time elapses and the finally makes the concrete to fail. The formation of cracks is the main reason for the failure of the concrete. To increase the tensile strength of concrete many attempts have been made. One of the successful and most commonly used methods is providing steel reinforcement. Steel bars, however, reinforced concrete against local tension only. Cracks in reinforced concrete members extend freely until encountering are bar. Thus need for multidirectional and closely spaced steel reinforcement arises. That cannot be practically possible. Fibre reinforcement gives the solution for this problem.

II. MATERIALS

A. Cement:

The cement used was ordinary Portland cement 53 (OPC 53). All properties of cement were determined by referring IS 12269 - 1987. The specific gravity of cement is 3.12. The initial and final setting times were found as 40 minutes and 580 minutes, respectively. Standard consistency of cement was 31%.

B. Coarse Aggregate:

20mm size aggregates-The coarse aggregates with size of 20mm were tested and the specific gravity value of 2.70 and fineness modulus of 5.9 was found out. Aggregates were available from local sources.

C. Fine Aggregate:

The sand which was locally available and passing through 4.75mm IS sieve is used. The specific gravity of fine aggregate was 2.63.

D. Human Hair Fibre:

The main element of hair composition is keratin. Keratins are proteins with long chains of amino acids that form the cytoskeleton of all cells of outer shell. Number of investigations clearly stated that sulfur is the main reason of strength of hair cords in front of disintegration in the face of environmental stress and these sulfur compounds are linked with amino acids at very high levels in hair cords. Sulfur in Amino acid molecules is adjacent to keratin protein till form disulfide chemical chains (chains are very strong and resistant to breakage). These chains are very resistant to acids disulfide performance, but in alkaline solutions they can decomposed. In fact alkaline environment looses the hair cords. The potential impact of reduced strength in the cement mortar is still a noteworthy but we have to mention that the purpose of this article is to investigate the impact of hair cord in control of shrinkage and cracks which are caused in normal concrete. Before the alkaline environment loose the hair cords, these cords may respond on purpose to their functions to prevent shrinkage.

III. EXPERIMENTAL WORK

A. Slump test

The slump value decreased with increase in percentage of hair fibre.

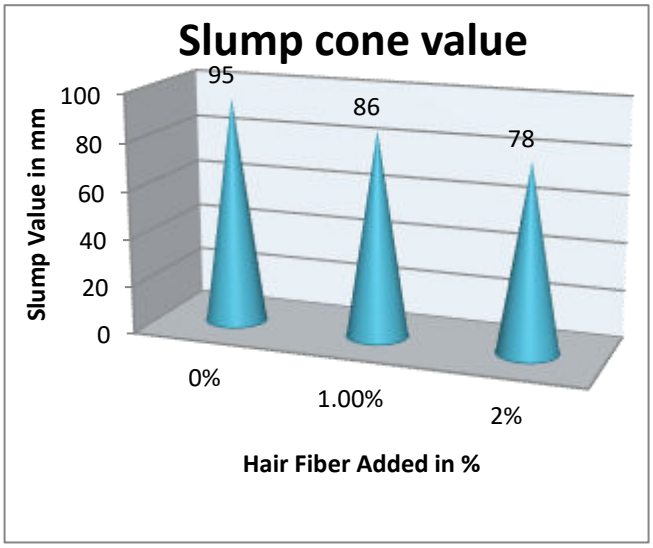

Fig.1 Slump Value for Fiber Concrete

B. Compaction factor test:

There was no much variation in compaction factor was very minute after addition of sisal fiber.

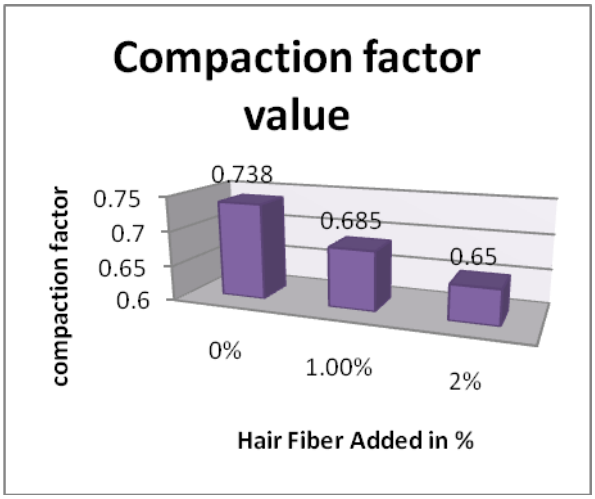

Fig.2 Compaction factor for Fibre Concrete

C. Compressive strength:

The compressive strength result obtained for 7days, 14 days and 28days it was observed that the compressive strength increased by adding 1% and 2% of hairfiber and it decrease in strength by adding of hairfiber.

Table.No:1.Compressive Strength of Fiber Concrete

Amount of hair Fibres (%)	7 days	14 days	28 days
0% hair	13.778	17.556	21.556
10mm 1% hair	15.555	18.667	23.556
10mm 2% hair	17.333	19.556	24.667
50mm 1% hair	13.333	14.667	24.667
50mm 2% hair	9.778	10.889	12.444

I. CONCLUSION

An effective way for controlling cracking caused by pasty condensation is to reinforce concrete by Fibres. Surveying effectiveness of Fibres on controlling condensation in mortar scale due to being simple in test and ability of obtained results popularization in concrete scale have well efficiency. Based on the test performed it is observed that there is increasein the properties of concrete due to the adding of percentage of human hair in it. The different sizes of human hair like 10 mm and 50 mm were added to the M_{20}grade concrete with following percentage like 0%, 1%, 2% and corresponding compression test value are noted. The compression test value of concrete will tests to rise in 12% due to addition 1% of 10mm human hair is it when compared to normal concrete value. The compression test value of concrete will tests to rise in 20% due to addition 2% of 10mm human hair is it when compared to normal concrete value. The compression test value of concrete will tests to reduce in 8% due to addition 1% of 50mm human hair is it when compared to normal concrete value. The compression test value of concrete will tests to reduce in 32% due to addition 2% of 50mm human hair is it when compared to normal concrete value. Above experiment, we found that 10mm human hair has high compressive strength than 50mm. therefore it has high efficiency and high withstanding ability.

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