International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May-2017 www.irjet.net p-ISSN: 2395-0072

COMPARATIVE STUDY FOR EVALUATION OF POLYPROPYLENE MONOFILAMENT AND HUMAN HAIR FIBRE IN PLASTIC SHRINKAGE CRACKING

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Abstract: *Due to rapid industrialization and urbanization the growth of population is get increase with the growth of population, increase the problem of pollution which hazardous to human being, plants, animal and living being. Technology gets very important role in the improvement in new innovation and new materials are develops due to research and experimentation. The material having some good advantages such as quality, strength, texture, material properties which give improves the performance of substance give high level of satisfaction. In 20th century cost of construction materials are also increases with quality of product. In our project we are reduced the price/cost of construction material while increase the strength of casted cubes.*

The concrete is material having highest bonding capacity with mixture of cement, water, fine aggregate and coarse aggregate, to improve the nature of concrete we add some extra material by adding admixture and reduce some percentage of ratio of cement , water & aggregate. In our project we discuss about the polypropylene monofilament and human hair fibre, the polypropylene monofilaments are increase property of concrete such as increase tensile strength, compressive strength and also increase the bonding capacity. In other case we compare the human hair fibre by adding in cement concrete mixture for increase bonding capacity of mixture and strength improvement. In this we give comparative study of both the material (polypropylene mono-filament & human hair fibre)

Key Words: human hair fibre, polypropylene fibre etc.

1. INTRODUCTION

Since the concrete is the oldest manmade building materials used by Romans as early as 509 B.C, concrete has become one of the most commonly used building material. Concrete used as building materials is a composite material made from several readily available constituents (aggregates, sand, cement, water). It is a versatile material that can easily be mixed to meet a variety of special needs and formed to virtually any shape. Concrete mainly consists of cement, fine aggregates, coarse aggregates and water which mixed together. Admixures added sometimes to change some of concrete properties. It is a widely used construction material because of its ease of construction, low cost of its ingredients and its good durability. The properties of concrete can be classified as fresh or hardened are discussed in the paper.

2. OBJECTIVES

1) To Study properties of cement concrete.
2) Study of nature of Polypropylene mono-filament and human hair fibre its properties.
3) Understanding the design procedure for different grades of cement.
4) Designing and casting of concrete cubes with different grades of cement.
5) Carrying out experiments on casting cubes with the UTM machines.
6) Study and analysis of experimental data.
7) Confirming the design and making changes if needed.

3. METHODOLOGY

1) Studying literature related to polypropylene mono-filament and human hair fibre.
2) Selection of different fine aggregate & coarse aggregate by sieve analysis.
3) Preliminary conceptual design and selecting of different grades of material for casting.
4) Casting of a cube with different grade of cement (M-15,M-20,M-25)
5) Carrying out tests in a UTM machine.
6) Case study (human hair fibre and polypropylene fibre).

4. EXPERIMENTAL WORK

4.1 MATERIALS

4.1.1 Cement: In experimental work Ordinary Portland cement of grade 53 grade is used as per IS: 10262. The properties of cement are as follow:

TABLE 4.1.1 PROPERTIES OF CEMENT

Sr. No.	Property	Value
1.	Specific Gravity	3.14
2.	Initial Setting Time	30 min
3.	Final Setting Time	600 min
4.	Fineness	225 m^2/kg

4.1.2 Fine aggregate: Clean River sand is used as fine aggregate. The size of it is less than 2.36 mm. The specific gravity and fineness modulus of this fine aggregate where found to be 2.66 and 2.56 respectively. The percentage of passing is within the limits as per IS: 383-1970.

4.1.3 Coarse Aggregate: The coarse aggregate used here is 20mm in size, crushed angular shape and free from dust. The specific and fineness modulus of this fine aggregate where found to be 2.6 and 2.98 respectively and the impact value was found to 12%. The percentage of passing is within the limits as per IS: 383:1970.

4.1.4Polypropylene mono-filament: Addition of polypropylene fibres to concrete increase of life of composite longer as per as give the strength to structure by controlling the micro cracks due to shrinkage during curing. The poly propylene mono filament fibre length is 25 mm and diameter of fibre is 44 micron is used. It has a low density is 0.9 kn/m^3.

TABLE 4.1.4 PROPERTIES OF POPYPROPYLENE FIBRE

Sr. No.	Property	Value
1.	Specific gravity	0.9
2.	Length	< 50 mm
3.	Aspect ratio	50-150
4.	Tensile strength	276 MPa
5.	Modulus of elasticity	3.24 GPa
6.	Critical fibre length	35 mm
7.	Breaking load	36 N

4.1.5 Human Hair: A human hair is used to get extra strength for making concrete specimen. These material are available easily at hair saloon and at location where kalkapam done temple, But we prepare the human hair from saloon. Human hair is first by chemical to their impurities and increase physical properties as follows:

TABLE 4.1.5 PROPERTIES OF HUMAN HAIR

Sr. No.	Property	Value
1.	Cross-section	Circular
2.	Diameter	18-100 µm
3.	Elongation	1.6 times its dry length
4.	Length	6-50 mm
5.	Specific gravity	Nil

A] Compressive Strength on Human Hair:

The compressive strength of concrete is its ability resist a crushing force. It is the ratio of load at failure to surface area of concrete specimen. Compressive strength test is the most common test conducted on hardened concrete as it is an easy test to perform and also most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength.

The compression test is carried out on specimens cubical in shape of the size 150 × 150 ×150 mm. The test is carried out in the following steps: First of all the mould preferably of cast iron, is used to prepare the specimen of size 150 × 150 ×150 mm. Calculated quantity of hair fibre is evenly added into the concrete mix manually. During the placing of concrete in the moulds it is compacted with the tamping bar with not less than 25 strokes per layer, After 24 hours the specimens are removed from the moulds and immediately submerged in clean fresh water. After 28 days the specimens are tested under the load in a universal testing machine is applied uniformly at the rate of 14 N/mm in compression testing. The test is made in the following manner: made for each M15, M2O and M25 and 1%, 1.5%, 2% **Human Hair** by weight of cement.

The results from the compression test are in the form of the maximum load the cube can carry before it ultimately fails. The compressive strength can be found by dividing the maximum load by the area of the test specimen. Let, P = maximum load carried by the cube before the failure A = contact area normal mm^2 = 22500 mm σ= maximum compressive stress (N/mm^2 equals to the compressive strength.) Therefore stress = P/A

B] Compressive Strength on polypropylene monofilament:

The compressive strength of concrete is its ability resist a crushing force. It is the ratio of load at failure to surface area of concrete specimen. Compressive strength test is the most common test conducted on hardened concrete as it is an easy test to perform and also most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength.

The compression test is carried out on specimens cubical in shape of the size (150 × 150 ×150) mm. The test is carried out in the following steps: First of all the mould preferably of cast iron, is used to prepare the specimen of size (150 × 150 × 150) mm. Calculated quantity of hair fibre is evenly added into the concrete mix manually. During the placing of concrete in the moulds it is compacted with the tamping bar with not less than 25 strokes per layer, After 24 hours the specimens are removed from the moulds and immediately submerged in clean fresh water.

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and 1%, 1.5%, 2% **Polypropylene Fibre** by weight of cement.

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Curing of concrete

After removal of mould after 24 hour concrete cube kept for curing for 7 and 28 days.

Photograph: 5 Curing Of Concrete Block

Photograph No: 6 (Casting of concrete with polypropylene fibre)

5. METHODOLOGY

Table 5.1 Details of Material required (For 1 cube)

Mix Proportion	M15	M20	M25
Quantity of cement (kg)	1.045	1.335	1.85
Quantity of sand (kg)	2.093	2.67	1.85
Quantity of coarse aggregate (kg)	4.18	4.00	3.7
Water cement ratio	0.48	0.5	0.55
Quantity of Hair (l %)	0.01045	0.0133	0.0185
Quantity of Hair (1.5%)	0.0156	0.020	0.027
Quantity of Hair (2.0%)	0.020	0.0267	0.037

6. Experimental Work:

6.1 Human hair in concrete

Table 6.1.1

Mix Design	Average compressive force (KN)	Average Compressive Strength N/mm^2
M-15 (1%)	326.7	14.52
M-15 (1.5%)	387.4	17.21
M-15 (2%)	405.2	18

Table 6.1.2

Mix Design	Average compressive force (KN)	Average Compressive Strength N/mm^2
M-20 (1%)	427.6	19.09
M-20 (1.5%)	449.8	19.33
M-20 (2%)	483.1	21.47

Table 6.1.3

Mix Design	Average compressive force (KN)	Average Compressive Strength N/mm^2
M-25 (1%)	508.4	22.59
M-25 (1.5%)	543.9	24.17
M-25 (2%)	556.4	24.73

6.2 Polypropylene Fibre in Concrete

Table 6.2.1

Mix Design	Average compressive force (KN)	Average Compressive Strength N/mm²
M15	340.8	15.14
M15	395.6	17.58
M15	421.7	18.74

Table 6.2.2

Mix Design	Average compressive force (KN)	Average Compressive Strength N/mm²
M20	433.7	19.27
M20	455.8	20.25
M20	490.2	21.78

Table 6.2.3

Mix Design	Average compressive force (KN)	Average Compressive Strength N/mm²
M25	520.3	23.12
M25	560.4	24.90
M25	570.3	25.34

7. CONCLUSIONS

As per obtained result of polypropylene monofilament in concrete and human hair fibre in concrete result strength of polypropylene is greater than human hair. But human hair is dangerous disposal and it has adverse effect on environment so human hair is also use in concrete in future.

Human hair waste can be effectively managed to be utilized in fibre reinforced concrete constructions. 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 cement in concrete. There was an overall increase of 1-10% in the compressive strength of concrete and test specimens by the addition of hair fibres in different quantities. It is well observed that the maximum increase is noticed in the addition of 2% hair fibre, by weight of concrete, in all the mixes. It is to be noted that maximum increase in the compressive strength is observed for lower concrete mixes, making the hair fibre reinforced concrete best suitable to use in the applications with those concrete mixes. Crack formation and propagation are very much reduced showing that hair fibre reinforced concrete can have various applications in seismic resistant and crack resistant constructions, road pavement constructions etc.

8. ACKNOWLEDGEMENT

We are thankful to **Prof. S.M. Gawande,** HOD of department of civil Engineering, Anantrao Pawar College of Engineering and Research, Pune for permitting us to undertake our project work under the supervision of internal project guide. We are also thankful to **Dr. S. B. Thakare**, **Principal, Anantrao Pawar College of Engineering and Research, Pune** for his help in various aspects.We are greatful to the staff and Libreary section of Anantrao Pawar College of Engineering and Research, Pune as well as our friends for their direct or indirect support in completing our project work.

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