International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 12 | Dec 2020 www.irjet.net p-ISSN: 2395-0072

Comparative Study on Strength of Concrete Structures using Human Hair and Nylon Fiber in Concrete

Sharad S. Kapale[1], Prof. M.S.Kariappa[2]

[1]M.E.Student M.S.Bidve Engineering College, Latur, Affiliated to Swami Ramanad Tirth Marathwada University, Nanded Approved by AICTE, Accredited by NAAC, Maharashtra, India
[2]Assistant Prof., Civil Engineering Department, M.S.Bidve Engineering College, Latur, Affiliated to Swami Ramanad Tirth Marathwada University, Nanded Approved by AICTE, Accredited by NAAC, Maharashtra, India

---

Abstract - *Fiber can be defined as a small piece of reinforcing material possessing certain dimensional characteristics. The properties of fiber reinforced concrete are very much affected by the type of fiber. The properties of fiber reinforced concrete are very much affected by the type of fiber. Fibers are secondary reinforced material and acts as crack arrester. Prevention of propagation of cracks originating from internal flaws can result in improvements in static and dynamic properties of matrix. Fiber reinforced cement and concrete materials (FRC) have been developed progressively since the early work by Romualdi and Batson in the 1960s. By the 1990s, a wide range of fiber composites and FRC products were commercially available and novel manufacturing techniques were developed for use with high fiber content. In parallel with the commercial development of FRC materials and products, an extensive research programme was undertaken to quantify the enhanced properties of FRC materials and more specifically to allow comparisons to be made between various types of fibers. Fiber reinforced concrete is one among those advancements which offers 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 generally strong in tension; hence it can be used as a fiber reinforcement material. Human hair Fiber is an alternative non-degradable matter available in abundance and at cheap cost. It also reduces environmental problems. Also addition of human hair fibers enhances the binding properties, micro cracking control, Imparts ductility and also increases swelling resistance. The experimental findings in our studies would encourage future* research in the direction for long term performance to extending this cost of effective type of fibers for use in structural applications. *Experiments were conducted on concrete cubes, cubes and beams of standard sizes with addition of various percentages of human hair fiber and nylon fiber. Experiments were conducted on concrete cubes, cubes and beams of standard sizes with addition of various percentages of human hair fiber and nylon fiber i.e., 0%, 0.7%, and 1.4% by weight of cement, fine & coarse aggregate and results were compared with those of plain cement concrete of M-30 grade. For each percentage of human hair and nylon fiber are added separately in concrete, cubes and beams were tested for their respective mechanical properties at curing periods of 7 and 28 days. Slump cone test were undertaken as well as hardened concrete test is compressive strength and Flexural Strength at the age of 7 and 28 days was obtained.*

Key Words: Waste Material, Non-degradable, Human Hair, Nylon Fiber Compressive Strength, Flexural Strength, Tension.

1. INTRODUCTION

Hairs are used as a fiber reinforcing material in concrete to study its effects on the compressive, crushing, flexural strength and cracking control to economies concrete and to reduce environmental problems created by the decomposition of hair. Concrete as one of the most widely used building materials, it is composed of three main elements: cement, sand and fillers in which they are bonded together by cement and formed concrete that is in fact a man-made stone. Its 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 Shrink age 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 increase perme ability, loss of concrete surface, reinforcement corrosion. Fibre reinforced concrete (FRC) is a composite material consisting of cement, sand, coarse aggregate, water and fibres. In this composite material, short discrete fibres are randomly distributed throughout the concrete mass. The behavioral efficiency of this composite material is far superior to that of plain concrete and many other construction materials of equal cost. Due to this benefit, the use of FRC has steadily increased during the last two decades and its current field of application includes: airport and highway pavements, earthquake-resistant and explosive-resistant structures, mine and tunnel linings, bridge deck overlays, hydraulic structures, rock-slope stabilization, etc. Extensive research work on FRC has established that addition of various types of fibres such as metallic and non-metallic fibre like (steel), glass, synthetic, and carbon, in plain concrete improves strength, toughness, ductility, post-cracking resistance.

Human Hair Fiber

Human hair is good in tension; hence it can be used as a fiber reinforcing material. Hair Fiber (HF) is a nondegradable matter available in abundance and at a very cheap cost. Human hair is considered as a waste material in most parts of the world and is a common constituent found in municipal waste streams which cause enormous environmental problems from its degradation. Also the high tensile strength, unique chemical composition, thermal insulation etc. makes the hair fiber suitable to be used as a reinforcing material. Experiments were conducted on concrete specimens with various percentages of human hair fibre i.e. 0%, 0.7% and 1.4% by weight of cement. Researchers found that there is an increment in the various properties and strength of concrete which makes it a suitable additive for concrete to enhance its mechanical properties.

Table - 1: Properties of Human Hair

Property	Value
Hair diameter	100 to 120μm
Hair length	60mm
Aspect ratio	500-600
Tensile strength of human hair fiber	380Mpa
Ultimate tensile strength	50.16%

1.1 Objectives of the project

- Waste Management of non-biodegradable Human Hair as a fiber reinforcement.
- Investigation of utilization of human hair waste as additional material in concrete mixes to be used for various construction projects, ensuring that the resulting concrete has proper compressive strength.
- To prepare mixes containing various proportions of the human hair waste and nylon fiber.
- Comparison of results of various characteristics with control mix.
- To minimize the cost of production of concrete by adding human hair waste with concrete mix.
- To control cracking due to both plastic shrinkage and drying shrinkage.
- To obtain abrasion and shatter resistance in concrete.

1.2 Scope of Work

- Amid investigate work we likewise confronted the issue of uniform appropriation of hair in the concrete. So a productive technique for blending of hair fiber to the concrete blend is to be discovered. A wide report on fractional substitution of bond utilizing fine hair fiber is to be done. It is important to think about the impact of length of fiber on high quality cement generally.
- The investigation of admixtures and super plasticizer which could disseminate the hairs without influencing the properties of cement The exploration can be additionally stretched out to consider the impact of hair fiber on different properties of composites such physical, warm properties and appearances.

2. Material Used

A. Cement:

Cement is a well-known building material and has occupied an indispensable place in construction work. There is a variety of cement available in market and each type is used under certain condition due to its special properties such as colour and composition of cement. The function of cement is first to bind the sand and coarse aggregates together and second to fill the voids. Although cement constitutes only about 10 percentage of the volume of the concrete mix, it is the active portion of the binding medium and the only scientifically controlled ingredient of concrete. Locally available cement is used. Like OPC (PARASAKTI- Cement).

B. AGGREGATE:

Vertical Shaft Impactor (V.S.I.) Sand is also known as Artificial Sand or Crushed Sand. Only sand manufactured by V.S.I. Crusher is cubical and angular in shape. There is standard specification for Fine Aggregates (Sand). It is divided in four gradations Zone-I, Zone-II, Zone-III & Zone-IV. Generally the size of the aggregate lesser than 4.75 mm is considered as Fine Aggregate. The broken stone is generally used as a coarse aggregate. Aggregate occupies most of the volume of the concrete. The aggregates were washed to remove dust and dirt and were dried to surface dry condition. Locally available Coarse Aggregate used of 20 mm and down size. Testing is done as per Indian Standard Specification IS: 383-1970. The size of the aggregate bigger than 4.75 mm is considered as Coarse Aggregate. The coarse aggregate passing through 20 mm sieve and retained on 4.75 mm sieve & specific gravity 2.68.

C. WATER

Water fit for drinking is generally considered fit for making concrete. Water should be free from acids, oils, alkalies, vegetable or other organic impurities. Water is used for mixing, curing purpose should be clean and portable, fresh and free from any bacteria and desire matter confirming to IS 3025-1964 is used for mixing. Soft water also produces weaker concrete. Water has two functions in concrete mix. Firstly, it reacts with the cement to form a cement paste; secondly it serves as a vehicle or lubricant in the mixture of fine aggregate and cement. Water is a key ingredient in the manufacturer of concrete. Ordinary tap water is used for concrete mix.

D. Human Hair:

The hair needed for the preparation of concrete cubes was collected from salons. It needs treatments before to be added in the concrete specimens. Human hair was used as a admixture in various percentages i.e. 0%, 0.7%, 1.4% by weight of cement for making concrete specimens.

Table - 1: Properties of Human Hair

Property	Value
Hair diameter	100 to 120µm
Hair length	60mm
Aspect ratio	500-600
Tensile strength of human hair fiber	380Mpa
Ultimate tensile strength	50.16%

E. Nylon Fiber:

A Nylon Fiber was used as a admixture in various percentages i.e. 0%, 0.7%, 1.4% by weight of cement for making concrete specimens.

Table 2: Properties of Nylon Fiber

Properties	**Values**
Appearance	Off- White Powder
pH (10% solids)	4.1 - 5.2
Bulk Density (Kg/l)	0.4 - 0.6
Specific Gravity	2.5
Loss on Ignition (%)	1.6

3 CASTING SPECIMEN

Test Test specimens of Cubes of size 150mm x 150mm x 150mm, beam with 700mm x 150mm x 150mm will prepared using the standard moulds. The samples are cast. The samples are remoulded after 24hrs of casting and kept in a water tank for 7 and 28 days curing. A total of 45 specimens cast for testing the properties such as compressive strength, and flexural strength. 30 cube samples of size 150mmx150mmx150mm for different percentages of human hair and nylon fiber separately is used as a admixture in various percentages i.e. 0%, 0.7%, 1.4% by weight of cement for making concrete specimens. All cubes will casted in one lift and consolidated using machine vibrator. After final setting of cubes, the cube moulds will be removed and cubes will kept in water tank for curing up to 7 and 28 days.

All specimen beams size 700mm × 150mm × 150mm will casted with optimum compressive strength for the specific mix in single lift and consolidated using tamping rods. After setting, the beams will covered with wet gunny bags. The burlap will be kept for 3days. At the end of the third day, the forms will stripped and beams will kept for curing up to 28 days.

4. EXPERIMENTAL METHODOLOGY

a) COMPRESSIVE STRENGTH

Compressive strength test is the most common test conduct on concrete because it is easy to perform and most of the desirable characteristics properties of concrete quantitatively related to its compressive strength. Compressive strength is determined by using compression testing machine (CTM) of capacity 2000KN. The load is applied at uniform rate. The cube specimen of the size 150 x 150 x 150 mm were tested after curing for period of 7 and 28 days for different combinations and results were compared with control specimens.

b) FLEXURAL STRENGTH

Flexural test on beams were carried out in universal testing machine of capacity 1000kN. Deflect meters were fixed to measure the deflection at salient points. The load acting at two points was applied without shock and increased until failure occurs. The load-deformation pattern was plotted and maximum load applied to the specimens were recorded.

The flexural strength test was determined according to B.S. 1881: part 118, 150 x 150 x 700 mm specimens were tested. The flexural strength of the specimens was calculated by the following equation.

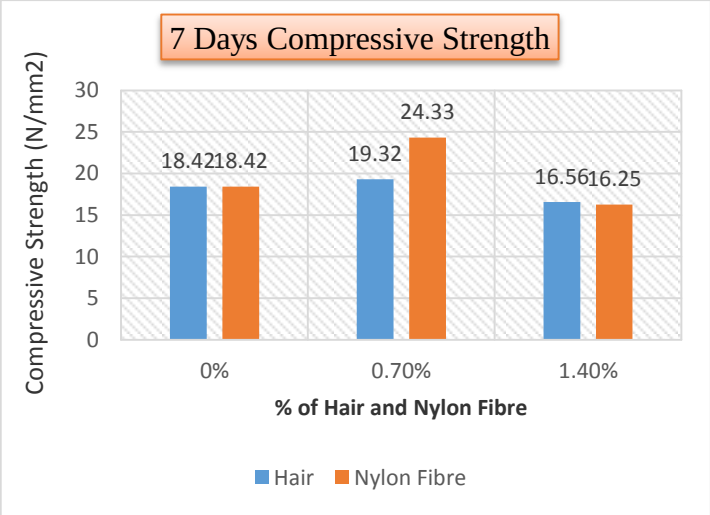
$$F_r = \frac{P \times L}{b \times d^2}$$

5. RESULTS:

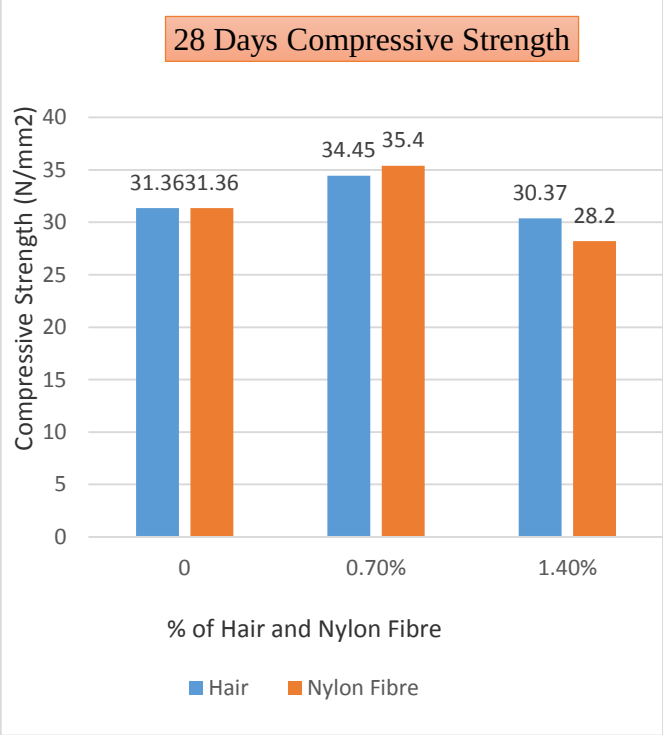
Results are obtained as follows:

A)Compressive Strength:

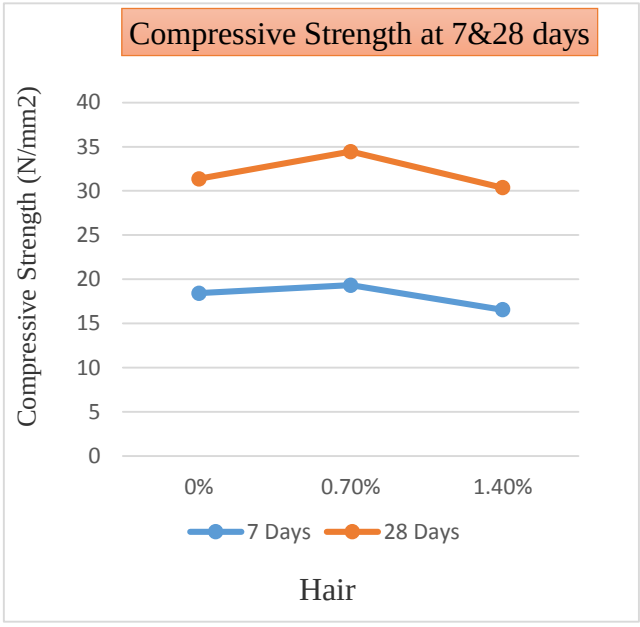
a) Results of comprssive strength for 7 days

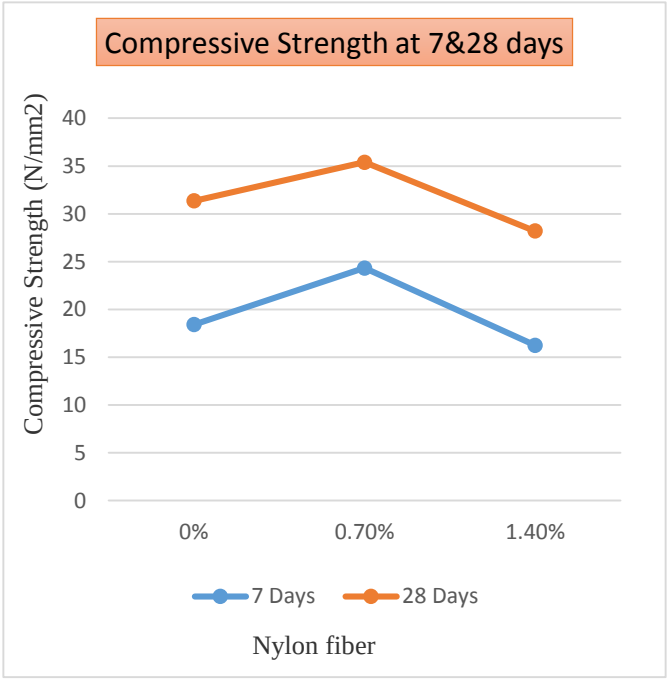


b)Results of compressive strength for 28 days



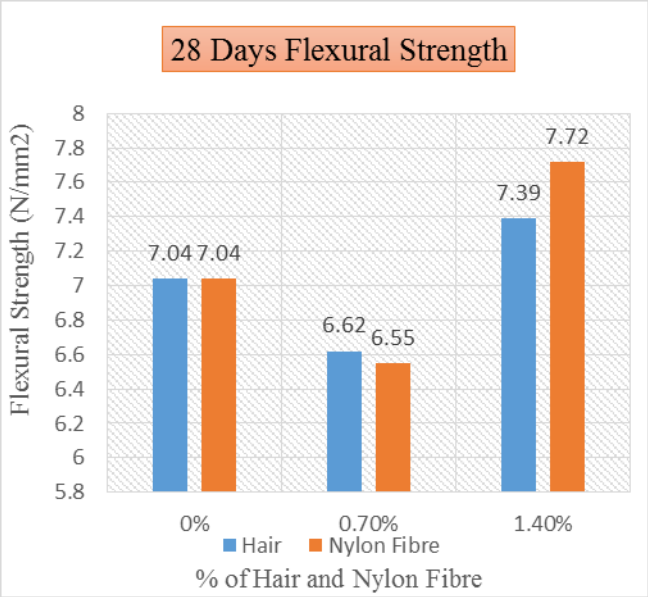
c)comparative results





B)Flexural Strength:

a)Results of flexural strength for 28 days



6.CONCLUSIONS:

Addition of human hair (natural fibers) and nylon fibers (artificial fibers) to the concrete mix can increase the compressive strength and flexural strength than normal concrete. The compressive strength of concrete is one of the most important and useful properties of concrete. The results indicate that the concrete properties were significantly influenced by using fiber. From this result, it is evident that for improving the properties of concrete, the percentage increment of compressive strength using nylon fiber than normal concrete. In the present investigation, though the available results clearly imply the influence of nylon fiber on the properties of fresh and hardened concrete.

- For cubes, at 0.7% use of mix nylon fiber we get 8% more compressive strength comparatively use of human hair which is also 18% more than normal concrete after 28 days of curing.
- For cubes, at 1.4% use of mixing nylon fiber we get less compressive strength comparatively use of human hair after 28 days of curing.
- For beams, at 0.7% use of mixing nylon fiber we get less flexural strength comparatively use of human hair after 28 days of curing.
- For beams, at 1.4% use of mixing nylon fiber we get 5% more flexural strength comparatively use of human hair which is 10% more than normal concrete after 28 days of curing.

Addition of human hair (natural fibers) and nylon fibers (artificial fibers) to the concrete mix can increase the compressive strength and flexural strength of normal concrete.

7. ACKNOWLEDGEMENT:

It gives me great pleasure in bringing out the project report entitled “Comparative Study on Strength of Concrete Structures using Human Hair and Nylon Fiber in concrete”

Though the following dissertation is an individual work, I could never have reached the heights or explored the depths without the help, support, guidance and efforts of lots of peoples. It gives the immense pleasure, to express my sincere and heartfelt gratitude to everyone who has contributed towards making my project work a memorable experience. I express a deep sense of gratitude and appreciation and indebtedness to my project guide **Asst. Prof. M. S. Kariappa**. & Co-ordinator of M.Tech (Structure) **Asst. Prof. A. A. Hamane** and Head of the Department **Prof. Deshpande S.G**. for their constant support and motivation throughout the project work. It was their interest and support which has leads me to this stage.

It is a genuine pleasure to express my deep sense of thanks and gratitude to my mentor, philosopher Principal **Prof. B. V. Dharne**, for their encouragement and motivation throughout the project work.

My sincere thanks to the Civil Engineering Staff for offering me valuable suggestions and time to time support at the time of need.I am extremely thankful to my friends for providing me necessary technical suggestions during my project report.

8. REFERENCES:

A. Majumdar A.J., Fibre cement and concrete - a review, Garston: Building Research Establishment, (1975).

B. Balaguru Perumalsamy N., Shah Sarendra P., Fibre Reinforced cement composites, McGrawHill International Editions (1992)

C. Johnston Colin D., Fibre reinforced cements and concretes, Advances in concrete technology volume 3 - Gordon and Breach Science publishes (2001)

D. Neville A.M., Properties of Concrete, (2005)

E. Ahmed S., Ghani F. and Hasan M., Use of Waste Human Hair as Fibre Reinforcement in Concrete, IEJ Journal, Volume 91 FEB, Page no 43, (2011)

F. Shetty M.S., Concrete Technology, (2009)

G. Naaman, A.E., “Fibre Reinforcement for Concretes.” Concrete international: Design & Construction, V.7, Mar. 1985, pp.21-25.

H. BIS IS 12269-2004 Specification for 53 grade ordinary Portland cement.

I. BIS IS 516-2004 Methods of test for strength of concrete.

J. Falkner, T.W. Falkner, Fibre Reinforced Concrete, Printed from: The technical advisor, June 1993.

K. Anirudh Swami, Shishr Gupta "Use of Nylon Fiber in Concrete" IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 05, 2016 | ISSN (online): 2321-0613

9. BIOGRAPHIES

KAPALE SHARAD S.
Student of M.E.(M.S.Bidve engg. College,Latur)

Prof. M.S. KARIAPPA
M.E. (STRUCTURE) Working as Asst.Prof.M.S.Bidve Engg.College, Latur.