Strength Characteristics of HDPE Fiber Reinforced Concrete

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ABSTRACT

Concrete is one of most widely used man made material, plays vital role in the development of infrastructure Viz., buildings, industrial structures, bridges and highways etc. leading to utilization of large quantity of concrete. It is very strong in compression and weak in tension. Many research works are carried out to improve the tensile properties of the concrete using different types of fibers. Fiber Reinforced Concrete (FRC) is an emerging field in the area of Concrete Technology. The present investigation is focused on the use of High-Density Polyethylene (HDPE) fiber in concrete percentage varying from 0 to 6% of fibers with 0.5% increment. Samples of cubes, cylinder and beams were tested for the compressive strength, split tensile strength and Flexural strength also comparison was made for the conventional concrete and modified concrete.

Keyword: *Concrete, Fiber Reinforced Concrete, High Density Polyethylene etc.*

1. INTRODUCTION

Construction is a major part of development plan of developing countries including India to meet the large demand for infrastructure development, maintenance and life Enhancement of structures is very important. Concrete is the most widely used man- made construction material. Micro cracks in concrete are formed during its hardening stage a discontinuous system exists even before the application of any external load when the load is applied micro cracks start developing along the planes which may experience relatively low tensile strains, at about 25-35% of the ultimate strength in compression. Further application of the load leads to tensile crack propagation in turn results in a low fracture toughness, and limited resistance to impact and explosive loading. Hybrid fiber reinforced concrete may be defined as composite material made with Portland cement, aggregate and incorporating discrete discontinuous fibers. Pavements made of concrete by using hybrid fiber provide durable service, life and has remarkable application under heavy traffic loading. If the hybrid fibers are sufficiently strong, sufficiently bonded to material, and permit the HFRC to carry the significant stresses over a relatively large strain capacity in the post cracking stage. Hybrid fibers of different sizes and types may play important roles in resisting cracking at different scales to achieve high performance. It has been proven that incorporating fiber in to cementitious materials can effectively improve their toughness and ability of resisting crack, and a lot of research work has been carried out on fiber reinforced cementations composites the hybridization of fibers provides improved specific or synergistic characteristics not obtainable by any of the original fiber acting alone.

1.1 Fiber Reinforced Concrete

Fiber reinforced concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinues, discrete, uniformly dispersed suitable fibers. And fiber is a small piece of reinforcing material possessing certain characteristics. They can be circular or flat the fiber is often described by the parameter aspect ratio which is ratio of fiber length to its diameter. Typical aspect ratio varies from 20 to 150. The use of fibers to reinforce a brittle material was done first by Egyptians they used straw to reinforce sun baked bricks and horsehair was used to reinforce plaster. In the early 1900's asbestos fibers were used in concrete. The modern

development of steel fiber reinforced concrete may have begun in 1960's. Glass fibers comes into picture by the 1980's and Carbon fibers from 1990's. And now a day's many types of fibers are available as a construction material and among them consumption of steel and polypropylene fibers is large.

2. MATERIALS USED

Cement: Ordinary Portland cement of 43 grade was used in this work. It was tested as per IS 8112-1989 recommendation.

Fig 1: Portland Cement

Fine aggregates: Natural sand confirming to IS 383-1970 of Zone II is used. Specific gravity, moisture content and absorption capacity of fine aggregate is calculated according to the procedures confirming to IS 2386 and results obtained comply with the code specifications

Coarse aggregates: Locally available crushed aggregates confirming to IS 383-1970 are used in this work. Specific gravity, Bulk density and water absorption capacity of coarse aggregate is calculated according to the procedures confirming to IS: 2386

Super plasticizer /Water reducing agents: CONPLAST SP 430 is a super plasticizing admixture is used in this experimentation. CONPLAST SP430 has been specially formulated to give high water reductions into 25% without loss of workability and produce high quality concrete of reduced permeability.

3. OBJECTIVES

1. To study strength properties of High-density polypropylene fiber reinforced concrete
2. To compare strength of HDPE reinforced concrete with conventional concrete mix

4. OBSERVATION AND RESULTS

A. Physical Properties of O.P.C 53 grade cement

Sl. No	Physical Properties	Results
1	Fineness of cement	3.5%
2	Specific Gravity	3.15
3	Normal consistancy	32%
4	Initial setting time	69minutes
5	Final setting time	228minutes
6	Compressive Strength for 28 days	56.8 N/mm^2

B. Compressive strength results

Sl No	HDPE fiber %	Sample No	Ultimate Load			Average Load in kN	Average strength (N/mm^2)
			Specimen 1	Specimen 2	Specimen 3		
1	0	S1	940	990	935	955	42.44
2	0.5	S2	930	970	1010	970	43.11

3	1.0	S3	1000	955	975	976.67	43.4
4	1.5	S4	950	1000	990	980	43.55
5	2.0	S5	970	1000	1000	990	44
6	2.5	S6	1000	950	960	970	43.11
7	3.0	S7	1000	1030	980	1003.33	44.59
8	3.5	S8	1000	1040	990	1010	44.88
9	4.0	S9	960	980	995	978.33	43.48
10	4.5	S10	960	920	975	951.67	42.3
11	5.0	S11	800	850	860	836.67	37.18
12	5.5	S12	720	800	730	750	33.33
13	6.0	S13	700	680	720	700	31.11

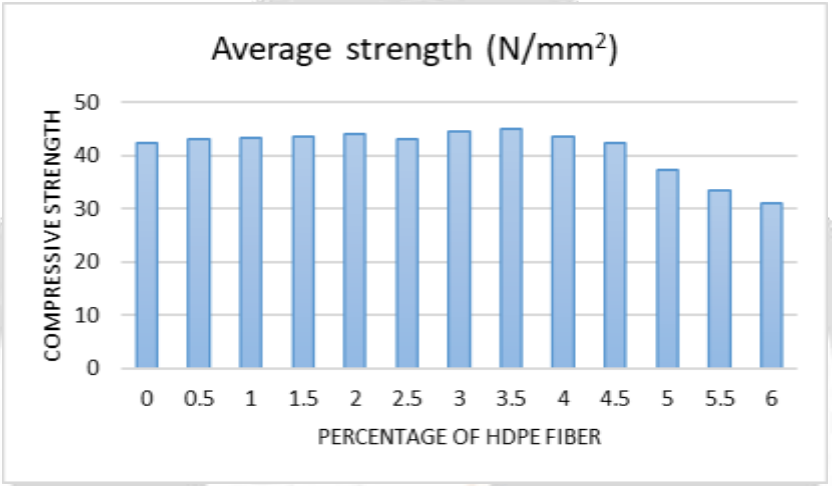

Fig 2: Graphical Representation of Compressive strength of HDPE fiber reinforced concrete

5. CONCLUSIONS

From the above results we can conclude that

1. HDPE fiber reinforced concrete with 3.5% fiber content has shown better results compared to conventional concrete
2. As fiber addition is increased after 3.5%, compressive strength of concrete is gradually decreased
3. HDPE fibers are non-biodegradable waste plastic, can be extracted from Jute cement bags. Therefore, usage of HDPE fiber is economic and environmentally friendly.

6. REFERENCES

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