iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** I **Month of publication:** January 2016

DOI:

Volume 4 Issue I, January 2016
ISSN: 2321-9653

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Study of Effects of Polyester Fibers on Compressive Strength of Concrete

Dr. Vagheesha S. Mathda[1], Ms. Hemali K. Khaire[2]
[1]B.E. M.Tech., Ph.D., [2]B.E. (CIVIL)

Abstract: The importance of concrete in modern society cannot be overestimated. Look around you and you will find concrete structures everywhere such as buildings, roads, bridges, and dams and it is very difficult to find another material of construction as versatile as concrete. Concrete also has its some drawbacks, to overcome these deficiencies fibers can be used as secondary reinforcement.The present work deals with results of experimental investigation of effect of use of Recron 3S polyester fiber on compressive strength of concrete. This has resulted into casting, curing and testing of 27 cube specimen of size (150 X 150 X 150) mm.
Keywords: Concrete; aggregate; recron 3Sfibers

I. INTRODUCTION

The recent development of Secondary reinforcement in Concrete in various fields has provided a strong technical base for improving the quality of the material. To overcome the deficiencies fibers are used as secondary reinforcement. FRC is Portland cement concrete reinforced with more or less randomly distributed fibers. The choice of fibers varies from synthetic organic materials such as polypropylene or carbon, synthetic inorganic such as steel or glass, natural organic such as cellulose or sisal to natural inorganic asbestos. The selection of the type of fibers is guided by the properties of the fibers such as diameter, specific gravity, Young's modulus, tensile strength etc and the extent these fibers affect the properties of the cement matrix.

II. IMPORTANCE OF FIBER REINFORCED CONCRETE

More recently micro fibers, such as those used in traditional composite materials have been introduced into the concrete mixture to increase its toughness, or ability to resist crack growth. In the present work polyester fiber have been used because,the advantages of using bonding characteristics of polyester which is better than nylon due to their functional side group present in the polymer structure. Polyester fiber designed specifically to provide concrete with protection against early age crack formation. Every fiber helps to prevent the tiny fissures that can occur when concrete's tensile strength is weakest. By reducing early age crack formation, the number of weakened planes and the potential for future crack formation may also be reduced. Although every type of fibre has been tried out in cement and concrete, not all of them can be effectively and economically used. Each type of fibre has its characteristic properties and limitations.

III. ADVANTAGES OF RECRON

Recron 3s is environmental friendly and non hazardous. It is easily disperses and separates in the mix. Only 0.2-0.4% by cement Recron 3s is sufficient for getting the advantages. Thus it not only pays for itself, but also results in net gain. So that it is beneficial to use recron 3S fibers as secondary reinforcement in constructions.

Recron 3S prevents the micro shrinkage cracks developed during hydration, making the structure/plaster/component inherently stronger. The modulus of elasticity of Recron 3s is high with respect to the modulus of elasticity of the concrete or mortar binder. Recron 3s fibre helps in increasing flexural strength.

IV. LITERATURE REVIEW

Jyoti Narwalet. al. [1] proved this theory by similar values from the ultrasonic pulse velocity test. It is seen from the results the cubes and beams having 1% fibre mix is showing surface temperature lower than the specimens with 0.5% and 0% fibre. It can be concluded that, as the percentage of fibre increases the specimen can handle high temperature and stays cool compared to the 0% fibre specimens. The present study was undertaken to investigate the behavior of steel fibrous reinforced concrete beams with conventional longitudinal reinforcement and shear reinforcement. In all, 13 beams were cast and tested. The addition of steel fibres in the concrete mix resulted in improved structural performance measure in terms of ultimate load carrying capacity, crack widths, deflection and curvature ductility factor of beam specimens of all the series. The optimum fibre volume percentage for all the series

Volume 4 Issue I, January 2016
ISSN: 2321-9653

was obtained as 1.5%. The further increase in fibre content reduced the load carrying capacity of the specimens due to poor compaction of concrete because of balling of fibres. With addition of steel fibres in concrete mix of the specimens the appearance of first crack was delayed. The presence of steel fibres also improved the post cracking behaviour of the specimens of all the series due to crack arresting phenomenon. The fibrous concrete specimens also exhibited better rotation capacity at ultimate load as compared to non fibrous concrete specimens.

Siddhesh Pai et. al. [2] concluded that the compressive strength reduction of the polyester fiber reinforced concrete depends more on the temperature to which it is subjected. As the temperature to which the specimen is subjected to increases, the compressive strength decreases. The results show that the compressive strength of the concrete decreases as the percentage of fibres added increases. From the results, it is inferred that the ultrasonic pulse velocity decreases as the temperature increases. There is a continuous and smooth decrease in the pulse velocity values for specimens having 0% fibres. In case of specimens having 0.5% and 1% fibres, the decrease in the pulse velocity values is more drastic, i.e. the graph shows a greater slope compared to that of 0% fibres. The inference is that the pulse velocity values goes on decreasing as the percentage of fibres added increases.

Dr. A.E. Naaman et.al.[3] For all practical purposes, progress in FRC composites was almost at a standstill for more than 100 years, and picked up at an exceptional pace only during the 1960s. This impetus may be partly due to fundamental research, better understanding of the reinforcing mechanisms of FRC composites, the need for materials with particular properties, developments in advanced materials, economic competitiveness, and global circumstances. A solid foundation has thus been built. It is likely that every area mentioned in the above discussion will see progress in the future. However, economic considerations will keep playing a major role. The increasing development and availability of strain-hardening FRC composites will provide enormous opportunities in structural applications, particularly to improve the damage tolerance of structures.

Khajuria et.al. [4] tested cylindrical concrete specimens are fabricated with 0, 1·5 and 3·0% fibre volume fractions. For each fibre volume fraction, stress–strain curves are measured using split Hopkinson pressure bar tests. Also, post-test photographs are taken for each specimen after each impact. The data collected are used to evaluate the energy absorption and the damage evolution of concrete in compression. The results indicate that damage increases and strength decreases with the increase of impact times. Fibrous concrete is markedly superior to plain concrete in resisting dynamic failure.

A.P.Singet. al. [5] showed that the permeability of concrete decreases significantly with the inclusion of steel fibres in concrete and continues to decrease with increasing weight fractions of fibres. This was observed for mixes tested after curing ages of 7, 14, 28 and 60 days. The permeability of plain as well as fibrous concrete decreases significantly with curing age. The compressive and split tensile strengths exhibit exponential relationship with coefficient of permeability for PCC as well as SFRC mixes. The relationship established for permeability, weight fraction of fibres and compressive strength of concrete are in good agreement with the observed values and can be used confidently for plain fibres.

V. EXPERIMENTAL WORK

The present work is based on percentages of fibers. The percentage of fibers is totally depending on cement quantity. It is taken by weight of cement. In present work specimens are tested for resulting compressive strength by using Recron 3S fibers. Fiber percentages taken for casting are varied from 0.2% to 1.8% for compressive strength at an interval of 0.2% by weight of cement. The second objective for conducting project is to calculate workability and comparing normal and fiber reinforced concrete.

A. Testing Of Materials And Grade Of Control Mix

Testing properties of cement, fine aggregate, coarse aggregate was done in accordance with the specifications in relevant Indian Standards. Indian Standard (IS 10262:2009) [5] method of mix proportioning was used for mix proportioning. The standard concrete (M30) is considered as reference concrete for comparing the results. All parameters in reference mix were kept constant and the effect of Recron 3S fibers on compressive strength of concrete was evaluated by varying fiber content. Fibre content was varied from 0.2% up to 1.8 % at an interval of 0.2 % by weight of cement.

PHYSICAL PROPERTIES RECRON

Sr.no.	Properties	Recron
1	Material	100% synthetic fiber
2	Shape of fiber	Speacially improve for holding aggregate
3	Specific gravity	1.36
4	Colour	Brilliant white

Volume 4 Issue I, January 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

5	U.V. Stability	Very good
6	Yongs modulus	$17.5x10^3$ MPa
7	Ult. Elongation %	50-70
8	Aspect ratio	340

B. Mixing Of Concrete

Mixing of concrete is important step for the preparation of cubes. Mixing of concrete with proper proportion of material is main requirement for the testing cubes. Purpose of mixing is to produce a mix of uniform consistency. This in turn gives consistent quality of specimens when cast in the mould. The coarse aggregate, fine aggregate, and cement were measured accurately and mixed in dry state for the normal concrete, then added accurately measured percentages of Recron 3s fibers. These percentages of fibers are taken by weight of cement.

C. Workability Of Concrete

After mixing of concrete we conducted workability test on concrete. Slump cone test is most commonly used method of measuring workability concrete in the laboratory. In this test workability is measured in terms of slump value. At every batch of mixing concrete slump is measured and recorded with slump cone apparatus.

D. Compressive Strength Test

A cube compression test was performed on standard cube of size 150mmx150mmx150mm after 28 days of immersion in water for curing. Compressive strength of cube was determined by using digital compression testing machine (CTM) of capacity 2000 KN

VI. RESULTS & DISCUSSIONS

Sr. No.	Fibre (%)	No. Cube	Comp. Strength(N/mm^2)	Avg. Comp Strength(N/mm^2)
1	0.2	1 2 3	55.55 46.66 60.00	54.07
2	0.4	1 2 3	53.33 51.11 52.00	52.15
3	0.6	1 2 3	41.77 49.33 44.88	45.33
4	0.8	1 2 3	47.55 46.66 48.00	47.30
5	1	1 2 3	33.33 51.11 46.66	43.7
6	1.2	1 2 3	42.22 31.11 33.33	35.55
7	1.4	1 2 3	53.33 40.44 37.77	43.84
8	1.6	1 2 3	35.11 37.77 40.44	37.33
9	1.8	1 2 3	48.88 53.77 51.11	51.4

VII. DISCUSSION

The compressive strength of Recron 3S fiber reinforced concrete is increased up to 1% and then varies. It happens due to effect of density. The density of some fibers is more than density of matrix. It affects the workability of concrete.

VIII. CONCLUSION

A. Workability of Recron 3S fibre reinforced concrete decreases with the increment of fibres. The water is absorbed by Recron 3S fibres so causing decrement in workability. The workability of concrete is higher at 0.2% of fiber but decreases as percentage of fibers increases.

B. Recron is beneficial for commercial use, as only 0.2-0.4% by weight of cement Recron 3S is sufficient for getting better compressive strength of concrete.

C. The optimum dosage of Recron 3S fibre for maximum compressive strength is 0.2%.

REFERENCES

[1] Narwal J, Goel A, Sharma D, “An Experimental Investigation on Structural Performance of Steel Fibre Reinforced Concrete Beam”, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-6, August 2013

[2] Pai S. & Chandra K**.**“Analysis of polyester fiber reinforced concrete subjected to elevated temperatures”International Journal of Civil, Structural,Environmental and Infrastructure Engineering Research and Development (IJCSEIERD) ISSN 2249-6866 Vol. 3, Issue 1, Mar 2013,

[3] Dr. A. E. Naaman CBM-CI International Workshop, Karachi, Pakistan. ACI Journal “High Performance fibre reinforced cement composite- Classification And Application”.

[4] Khajuria A, Chien A, and Balaguru P. “Toughness characteristics of fiber reinforced concrete,” Civil Engineering Department Report No.90-11, 1990, pp 46.

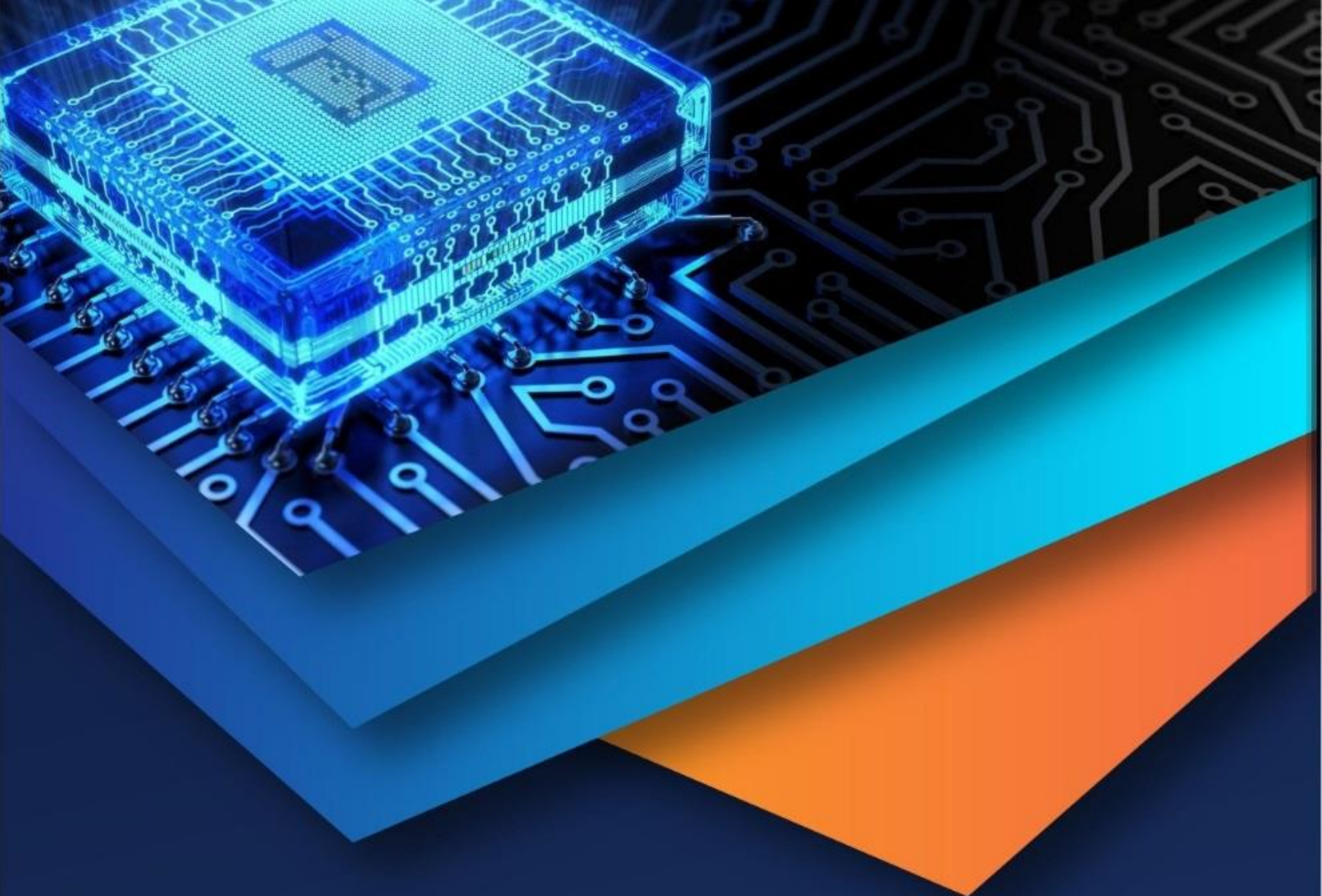
[5] A P Singh&DSinghal, “Strength and permeability relationship of steel fibrous concrete”35thConference on OUR WORLD IN CONCRETE & STRUCTURES: 25 - 27 August 2010, Singapore.

[6] Shah, S. P, and Rangan, B. V, “Ductility of concrete Reinforced with stirrups, Fibres and compression Reinforcement,” ASCE, Journal of the Structural Division. Vol.96, No.6, 1970, pp.1167-1184.

[7] D. Jothi, **“**Application of Fiber Reinforcement Concrete Technique in Civil Constructions” (pp. 157-172*)*African research review, An International Multi-Disciplinary Journal Volume 2 (4) September, 2008

[8] Anne laning “synthetic fibers” Magzine published in 2010.

[9] Salah Altoubat, ArdavanYazdanbakhsh, and Klaus-Alexander Rider”, “Shear Behavior of Macro-Synthetic Fiber-Reinforced Concrete Beams without Stirrups technical papers V. 106, No. 4, July-August 2009



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY