ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 6, Issue 6, June 2020

Behaviour of Fiber Reinforced Concrete using Recron 3S

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***Abstract*— The present day world is witnessing the construction of very challenging and difficult civil engineering structures. Quite often, concrete being the most important and widely used material is called upon to possess very high strength and sufficient workability properties. Efforts are being made in the field of concrete technology to develop such concretes with special characteristics. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. Hence an attempt has been made in the present investigations to study the influence of addition of recron 3s fibre in concrete. Fibres provide improvements in tensile strength flexural strength, fatigue characteristics, durability, shrinkage characteristics, impact, erosion resistance and serviceability of concrete. Fibres impart energy absorption, toughness and impact resistance properties and improve the fracture resistance in concrete.Experimental study was done using M20 mix and tests were carried out as per recommended procedures by relevant codes. The results were compared with conventional concrete.**

***Index Terms*—Concrete Structures, Recron 3S, Fiber, Flexural Strength, Fatique, Conventional Concrete.**

I. INTRODUCTION

Concrete is a material made of cement, water, fine aggregate and coarse aggregate, which has very good compressive strength and poor tensile strength. In order to provide tensile strength to concrete usually steel has been provided as reinforcement, which is called reinforcement concrete. There are many ways to minimize the failure of the concrete structures made of steel reinforce concrete. The customary approach is to adhesively bond fibre polymer composites onto the structure. This also helps to increase the toughness and tensile strength and improve the cracking and deformation characteristics of the resultant composite Processes involved in this project are mix design, preparing samples with and without fibre, testing of cubes, cylinders, prism and analysis of results. Here we have added recron 3s fibre, in a weight basis by 0.5%, 1%, 1.5%, 2%. As we know the concrete is strong in compression and weak in tension, this paper is aimed to increases its compressive strength and tensile strength .At first cubes are made with M_{20}grade as per IS10262-1982 after that recron 3s fibre is introduced. After 7, 14, 28 days of curing the cubes, cylinders and prism are tested for the compressive strength and tensile strength of concrete respectively and results are compared. Section that you want to designate with a certain style, and then select the appropriate name on the style menu. The style will adjust your fonts and line spacing.

II. FIBER REINFORCED CONCRETE

Normal reinforcing steel is designed to take account of all tensile and bending stresses as well as temperature related stresses in concrete structures. The design parameters are well established in the Indian Standard Code IS 456 and are minimum structural requirement for design and construction. These required steel are termed for this paper as primary steel. Use of secondary reinforcements does not alter the requirements of "Primary Steel". But structural reinforcement does not provide its benefits until concrete hardens. Hence secondary reinforcement in form of fibre reinforcement should be added to concrete. Unlike structure reinforcement, synthetic fibres provides benefits while concrete is still in plastic stage. They enhance some of the properties of hardened concrete also. Hence it is proved that by addition of small quantities of evenly distributed secondary fibre reinforcement improves the static and dynamic properties of concrete. Fibre Reinforced Concrete provides three dimensional random reinforcement in the entire mass of the concrete. The properties which fibres induce is totally intrinsic to the type and number of fibres being administered with concrete i.e. each type of fibre will induce different kinds of characteristics into the concrete mass. As a whole Fibre Reinforced Concrete has greater resistance to Drying Shrinkage Cracking, Compressive Strength, and Tensile & Flexural strength, Abrasion and Impact Resistance and Water Permeability/Penetration.

Recron 3s is a triangular polyester fibre in cross section with cut length of 6mm & 12mm which is being widely used in the Indian Construction industry market. It is much cheaper than any other imported construction fibres. At the specified dosage of 0.25% by weight of cement there are millions of fibres which form a mesh in the concrete. the spacing is approx less than 1mm between any two fibre filament in any coordinate of the matrix.

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Fig.1 Recron 3S Fiber

III. EXPERIMENTAL WORK

A. Compressive Strength:

Determination of compressive strength of concrete is a very important parameter because the concrete is primarily mean to withstand compressive stress The compressive strength given by different specimen for the same concrete mixes are different the cured specimens are placed in compressive testing machine and load is applied. The compression test develops a more complex system of stresses Due to compression load ,the cubes undergoes lateral expansion owing to the poisson's ratio effect .at the limiting effect .at the limiting load the specimen breaks and the load is noted.

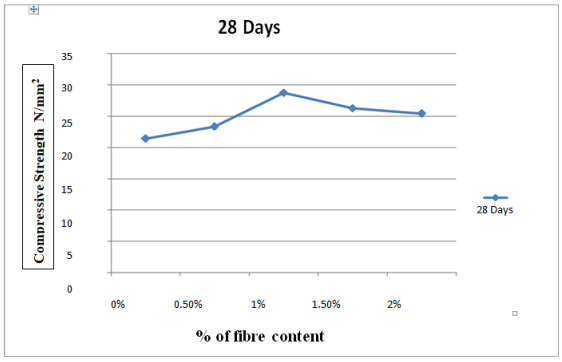

Fig.2 Percentage of Fibre Content vs Compressive Strength of Concrete

B. Tensile Strength:

The cylindrical specimen shall have diameter not less than four times the maximum size of coarse aggregate and not less than 150 mm. the length diameter of the specimens shall not more than twice the diameter .for specimens shall be cylinder 150 mm in diameter and 300 mm long. the test is carried by out by placing a cylindrical specimen horizontally between the loading surfaces of a compression testing machine and the load is applied until failure of the cylinder, along the vertical diameter. When the load is applied along the generatrix an element on the vertical diameter of the cylinder is subjected to a horizontal stress.

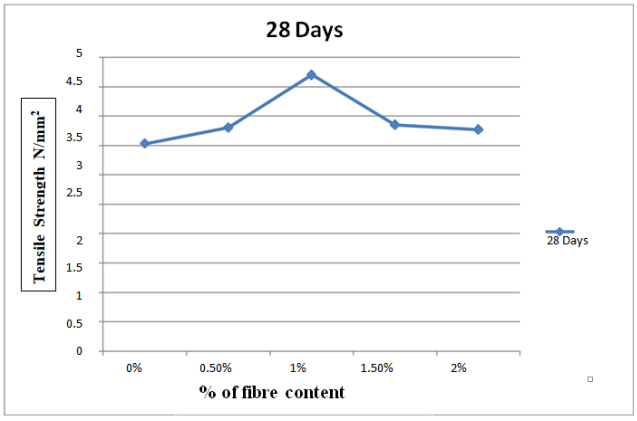

Fig.3 Percentage of Fibre Content vs Tensile Strength of Concrete

C. Flexural Strength:

The flexural strength would be the same as the tensile strength if the material were homogeneous. In fact most materials have small or large defects in them which act to concentrate the stresses locally, causing a localized weakness. When a material is bent only the extreme fibres are at the largest stress so, if those fibres are free from defects, the flexural strength will be controlled by the strength of those intact fibres However, if the same material was subjected to only tensile forces then all the fibres in the material are at the same stress and failure will initiate when the weakest fibre reaches its limiting tensile stress. Therefore it is common for flexural strengths to be higher than tensile strengths for the same material. Conversely, a homogeneous material with defects only on it surfaces (e.g. due to scratches) might have a higher tensile strength than flexural strength. If we don't take into account defects of any kind, it is clear that the material will fail under a bending force which is smaller than the corresponding tensile force.

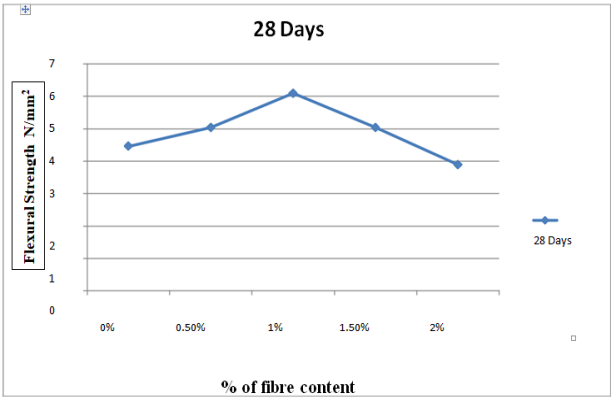

Fig.4 Percentage of Fibre Content vs Flexural Strength of Concrete

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IV. RESULTS AND DISCUSSIONS

Compressive Strength:

- Compressive strength of recron 3s fibre is higher than the hybrid fibre (steel fibre and recron 3s fibre)
- Compressive strength of recron 3s fibre is twice higher than the hair fibre
- Compressive strength of recron 3s fibre is higher than the domestic waste as fibre
- Compressive strength of recron 3s fibre is higher than the glass fibre

Tensile Strength:

- Split tensile strength of recron 3s fibre is twice higher than polyester fibre
- Split tensile strength of recron 3s fibre is equal to polypropylene fibre
- Split tensile strength of recron 3s fibre is higher than domestic wastes as fibre
- Split tensile strength of recron 3s fibre is higher than the hair fibre

Flexural Strength:

- Flexural strength of recron 3s fibre is higher than domestic wastes as fibre
- Flexural strength of recron 3s fibre is equal to the hybrid fibre(steel fibre and recron 3s fibre)
- Flexural strength of recron 3s fibre is equal to polypropylene fibre

V. CONCLUSION

The compressive strength of all the fibre percentage of dosage was found to increase with inclusion of fibres in the plain concrete. However, specimens having 1 % volume fraction of Recron 3s fibre indicated the marginal increase of 25.43%. The split tensile strength of all the fibre percentage of dosage was significantly higher than that of plain concrete. An increase of 24.90% of split tensile strength was indicated by having 1 % volume fraction of Recron 3s fibre. This is because in fibre when it cracks, the presence of fibres causes the load to be transferred from the cementitious composite to the fibres at the crack interface, thereby increasing the tensile load carrying capacity of the fibre. Flexural stress of having 1 % volume fraction of Recron 3s fibre was found to increase by 26.90% compared to plain cement concrete. These apparent toughness indices were based on the cross head deflection at the loading point. Due to comparative nature of the present study, the absolute values of the toughness may not be of much importance. Further, plain cement concrete beam specimen indicated a sudden (brittle) failure whereas fibre specimen indicated a ductile behavior.

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