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Increase Compressive Strength of Concrete by Using Polypopylean Fibres

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ABSTRACT

Now a days in construction field challenge is to increase the strength of the structure ,which is depend on concrete also. whereas,Fibrous high-strength concrete by means of natural and technogenic raw materials is in demand for sustainable construction. to improve the performance and properties of high-strength concrete with an improved composite binder and polypropylene fiber. The task was achieved by using a powdered mineral modifier, the introduction of which will make it possible to effectively control the processes of synthesis of hydration products during the hardening of the cement composite. to develop high performance concretes by using fibers and other admixtures in concrete up to certain proportions. Hence, in this paper was interested in finding out the optimum quantity of polypropylene fibers required to achieve the maximum compressive strength for M25 grade concrete. From the exhaustive and extensive experimental work it was found that with increase in polypropylene fiber content in concrete there was a tremendous increase in compressive strength. Even at 2 % polypropylene fiber content compressive strength of 28 N/mm2 was observed against compressive strength 25 N/mm2 at 0 % hence increase of 12 % compressive strength was obtained.

Keywords: Polypropylene, Fiber, Strength, Fiber Reinforced, Concrete

I.INTRODUCTION

Ordinary concrete is widely used in construction projects because of its low cost and good compressive performance. However, given the low tensile strength and toughness of concrete, the building structure cannot be effectively controlled after cracks occur under load, which leads to the failure of internal steel bars to resist external erosion media, thereby affecting the durability of the structure. Therefore, finding a material with good tensile property and effective crack control is important.Concrete is the most used building material worldwide with its usage doubling the combined consumption of wood, steel, aluminum and plastics. Activities linked to concrete, from the production of the constituent materials to the end user applications produces millions of jobs opportunities worldwide and contributes immensely to the Gross Domestic Product (GDP) of most nations of the world. It is the most used man-made product in the world and the mover of world economy as it is one of the basis of large commercial industries.According to the US National Ready Mixed Concrete Association, in the United States alone, readymix concrete production generates over $30 billion per year for the concrete industry. In Nigeria, majority of the structures are constructed using concrete with a consumption rate of cement estimated at

106kg per person as at 2011. The massive use of concrete in Nigerian building industry is typified by the very high rate of over 95% cases of building collapses verified in Nigeria affecting concrete houses. The vast size of the concrete industries worldwide and the ever evolving ways in which concrete is being used continually since its discovery as a construction material makes it difficult to overstate the importance of this material. Concrete is made up of cement, aggregates and water. Fine and coarse aggregates are mixed with cement, usually Portland cement and water to produce a composite material. Cement and water mixes to form the paste that serves as a binder to the aggregates. After mixing, the paste-aggregate combination hardens and gains strength to form rock-like masses due to a chemical process known as hydration. As water reacts with cement to form the matrix of the composite material, hydration of the paste enhances bond of the other components and confers greater strength to the mix over time. The resulting product is one of the most durable building materials as concrete structures have a long service life of up to 100 years approximately. It is fire resistant especially when compared to wood. Concrete is good in compression, but very weak in tension and under flexural stress and so it is usually reinforced with materials that are strong in tension (conventionally steel bars but in recent times with fibers). The combination of concrete and reinforcing bars gives rise to reinforced concrete which marked a major advancement in the construction industry and paved way to modern complex structures. Concrete serving as matrix in the composite material absorbs the compressive stress and protects the reinforcement from corrosion while the steel is able to distribute the tensile stresses that cause concrete to crack and ultimately fail.

Polypropylene fiber is a synthetic fiber with low density, fine diameter and low modulus of elasticity. It has some special characteristics such as high strength, ductility and durability, abundant resources, low cost, and easily physical and chemical reformations according to certain demands. Thus it can be widely utilized in the field of concrete products. In this study the influence of different amount of polypropylene fibers content on concrete properties were investigated by measuring compressive strength.

II. LITERATURE AND REVIEW

MR. Mehul - [1] The paper deals with the effects of addition of various proportions of polypropylene fibers on the properties of High strength concrete. An experimental program was carried out to explore its effects on compressive, tensile, flexural, shear strength and plastic shrinkage cracking. A notable increase in flexural, tensile and shear strength was found. The main aim of the investigation program is first to prepare the strength of concrete of grade M40 with locally available ingredient and then to study the effect of different proportion of Polypropylene fiber in the mix and to find optimum range of Polypropylene fiber content is 0.5%,1.0%,1.5% in the mix. The concrete specimens were tested at different age level for mechanical properties of concrete, namely, cube compressive strength, split tensile strength, flexural strength and other test were conducted for cement, chemical admixture, coarse aggregate & fine aggregate.

Vahid Afroughsabet –[2] This paper presents an experimental study that investigates the influence of the low fiber content of polypropylene and hooked-end steel fibers on the properties of high-strength concrete. The study variables include fiber types and fiber contents. The effect of combining both fibers with a total fiber content of 1.0% was also studied in some mixtures. Silica fume, as a supplementary cementitious material, was used at 10%

of the cement weight in all fiber-reinforced concrete mixtures. Compressive strength, modulus of elasticity, longitudinal resonant frequency, rapid chloride migration and free drying shrinkage tests were performed for different curing ages. The results show that replacement of the cement weight with 10% silica fume improved all of the characteristics of the concrete evaluated in this research study. It was observed that the inclusion of fibers, particularly steel fibers, enhanced the mechanical properties of concrete. It was found that the incorporation of polypropylene fibers resulted in a reduction of chloride diffusivity, while introducing steel fibers significantly increased the chloride diffusivity of concrete. Finally, the results showed that hybridization of two types of fibers was an effective way to improve the properties of concrete and specifically reduce the drying shrinkage compared with that of the plain concrete.

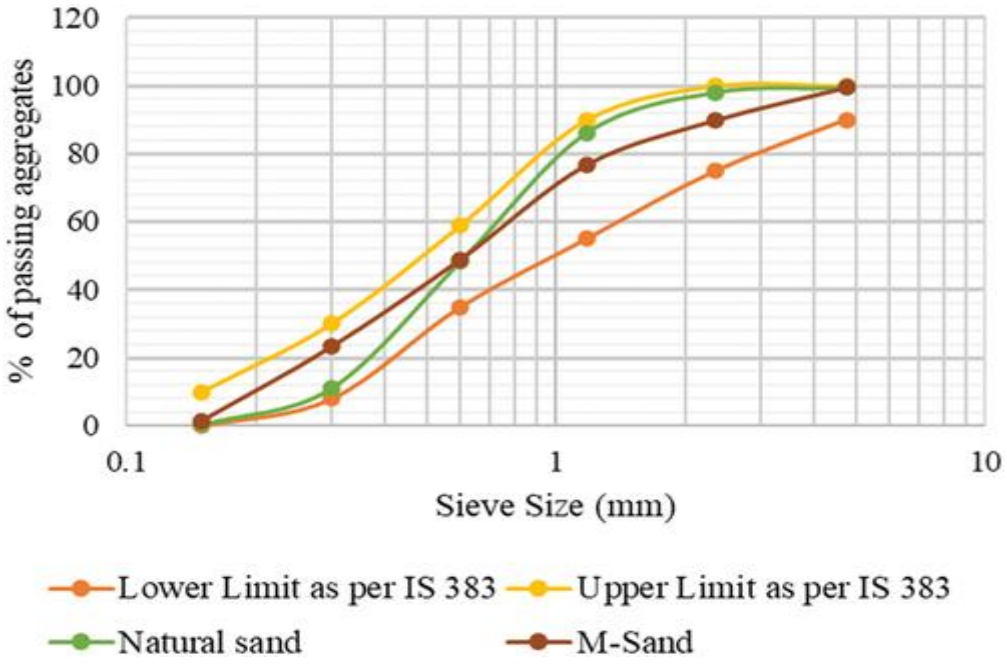
Bentur A - [3] At Fibre Concrete Solutions, we supply a series of **market leading fibres** specialised for concrete reinforcement, as well as providing expert advice on designing all aspects of fibre reinforced concrete structures. We provide our customers in the concrete construction industry with innovative and cost-effective solutions, utilising our expert knowledge drawn from over 100 years of collective experience in practical fibre reinforced concrete applications.

III. MATERIALS AND METHODOLOGY

The Portland Pozzolana Cement (PPC), two types of fine aggregates, coarse aggregate, polypropylene fibres (PPF), potable water and superplasticiser are used in the concrete mix. The PPC cement with 32% fly ash content confirming to IS 1489 (BIS:Citation1489Part 1, 1991) with specific gravity of 2.92 and having a fineness of 4% (i.e. % weight retained on a 90 µm IS sieve) is used as a binder in SCC. The initial and final setting time of PPC after testing was found to be 41 minutes and 366 minutes, respectively.

The angular aggregate of crushed granite stone of size 4.75 to 12.5 mm is used as coarse aggregate. The size distribution of considered coarse aggregate from the sieve analysis in terms of percentage passing are 96.8, 67.09 and 5.45 for sieve sizes of 12.5 mm, 10 mm and 4.75 mm, respectively. River sand and crushed granite stone sand, that is, M-sand are used as fine aggregates in the study. The fine aggregate and coarse aggregates considered are free from all deleterious materials. The properties of the aggregate considered are tabulated in Table 2. The grain size distribution of the fine aggregates considered is shown in Figure 1. Aggregates are tested as per IS 383–1970 (IS:383, Citation1970).

Figure 1. Sieve analysis results of fine aggregates.



To reduce the water content, polycarboxylate ether based superplasticiser is used as the high range water reducing agent. The admixture selected in this study acted as a water reducing agent and viscosity modifying agent, since it has both properties. As per the specification, the specific gravity of the considered admixture is 1.09. After many trials, the dosage selected for the present study is 0.7% of the binding material content. With this, the PPF used in this work has a diameter of 24 microns, length of 12 mm and a specific gravity of 0.9. Figure 1 shows the polypropylene fibre.

Figure 1. Image of the polypropylene fibres.

IV. RESULTS AND DISCUSSION

Compressive Strength of Polypropylene Fiber On Concrete Mixes -

The compressive strength values of the cube specimens at the age of 28 days are as shown in fig 3. It has been observed that the compressive strength of concrete for the cubes with polypropylene fiber 1%, 1.50% and 2% is more than that of cubes without polypropylene fiber 26 N/mm2 , 26.40 N/mm2 and 28 N/mm2 respectively compare with control mix without polypropylene fiber as compressive strength was 25 N/mm2. This may be due to the fact that the polypropylene fiber will effectively hold the micro cracks in concrete mass. The percentage

increase in the compressive strength for the cubes with polypropylene fiber 1%, 1.5% and 2% compared to the cubes without polypropylene fiber are 4%, 5.6% and 12 % respectively. It can be seen from the observations that the maximum percentage increase in compressive strength can be obtained for the cubes with polypropylene fiber 2%. Thus it is recommended to use polypropylene fiber 2% to get the maximum benefit in improving compressive strength. In a nutshell it can be concluded that the use of polypropylene fiber is an effective method to improve the compressive strength of concrete. To get the maximum benefit it is recommended to use polypropylene fiber 2%. More percentage of polypropylene fiber will have the workability problem & also air cavities are left in the system.

V. CONCLUSION

1.The compressive strength was compared of the cubes prepared.

2.we suggest that since the strength of concrete increases with the addition of fiber, fibers can be added to the concrete for the structure and it can be used in the construction of high rise buildings, bridges etc.

3. Suitability of Concrete Reinforced with Synthetic Fiber for the Construction of Pavements.

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