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An Overview on Characteristic Strength of Concrete by using Plastic Fibre

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Abstract: ***Concrete masonry units are a common method of construction in the world. Since the masonry units can be constructed with ease. Fifty billion water bottles are consumed every year. Lack of waste management and recycling in third world countries has come to the attention of many organizations. The use of plastic bottles fibre waste in construction materials has been around for the past twenty years. This plastic fibre waste can be used in concrete production. This study presents the results of a various test conducted to determine the compressive strength and workability of concrete with plastic bottle waste. The testing for compressive strength was determined according to the IS codes. In last few years there has been significant growth in the construction of building and roads and various other Civil Engineering projects. Addition of Admixtures and various other materials in concrete has become an important phenomenon to get higher strength of concrete with the same proportion of material at cheaper rate. This work focuses is to determine the compressive strength of cube and workability of normal M20 grade concrete with the addition of plastic fibre with super plasticizer in the concrete which lead to increase in the compressive strength of cube, workability of specimen of M20 grade concrete.***
Keywords: Plastic fibre, Flexural strength, Cement, Compressive Strength

I. INTRODUCTION

Plain concrete has two major deficiencies - a low tensile strength and allow strain at fracture. The tensile strength of concrete is very low because plain concrete normally contains numerous micro cracks. The rapid propagation of these micro cracks under applied stresses is responsible for the low tensile strength of material.

These deficiencies have lead to considerable research aimed at developing new approaches to modifying the brittle properties of concrete. Current research has developed a new concept to increase its ductility and energy absorption capacity as well as to improve overall durability. This new generation technology introduces the discrete steel or synthetic fibres added into the conventional concrete to modify it's properties. Fibers are generally utilized in concrete to manage the plastic shrink cracking and drying shrink cracking. They also help in modifying the permeability of concrete and therefore reduce the flow of water. Some types of fibers create greater impact, abrasion and shatter resistance in the concrete. Usually fibers do not raise the flexural concrete strength. The quantity of fibers required for a concrete mix is normally determined as a percentage of the total volume of the composite materials. The fibers are bonded to the material, and allow the fiber reinforced concrete to withstand considerable stresses during the post-cracking stage. The actual effort of the fibers is to increase the concrete toughness. In present study we use waste plastic bottle strips in concrete for M20 mix design. Various percentages of strips is like 2 %, 4 %, 6 % and 8 % with super plasticizer.

A. Objectives

1) To investigate the compressive strength behavior of concrete by using plastic waste.
2) To find the percentage upto which mix of plastic in concrete is in suitable limit.
3) To determine the variation in workability by using plastic in different percentage.

II. LITERATURE REVIEW

Many studies have been reported in literature on the performance of the concrete containing plastic fibre and some of important studies are briefly presented below:

Seghiri et al. (2017) Study showed the experimental test program was conducted on the polymer roof tile containing different percentages (30%, 40%, 50%, 60%, 70% and 80%) of recycled (HDPE) from the weight of the mixture. Experimental tests were conducted on density, the breaking load showed that the density decreases with the increase of the HDPE ratio that gives the

polymer tile to a light weight. And also the polymer roof tile containing 70% HDPE with 30% sand dune gives the best quality. Further all polymer roof tile mix gives a good results in the permeability coefficient according the standard.

Vali et al. (2017) showed that the compressive quality expanded up to 10% supplanting of the fine total with PET container filaments and it step by step diminished for 15 % and 20% substitutions. Thus supplanting of fine total with 10% substitution will be sensible. The flexural quality expanded up to 10% supplanting of the fine total with PET container waste and it slowly diminished for 15% and continues as before for 20% substitutions.

Ilya et al. (2017) This research was carried out to study the behaviour of concrete, specifically compressive and flexural strength, by incorporating recycled soft drink aluminium can as fibre reinforcement in the concrete. Laboratory test results based on short term investigation reveals that the compressive strength and flexural strength of concrete containing fibre are higher than of normal OPC concrete. Among two volume fractions, concrete with 1% of soft drink can fibre have performed better result in compressive strength and flexural strength compared with 2% amount of soft drink can fibre. The optimum proportion of aluminium fibre to be added in the concrete as fibre reinforcement is 1% fibre content by weight of cement which gave all the positive response from all the tests conducted.

Safinia et al. (2016) This study utilized 500-mL plastic bottles placed inside concrete masonry units and analyzed the compressive strength. The testing for compressive strength was determined according to the ASTM C140 standard. Results from this study were deemed reasonable due to the testing of concrete cylinders as a control of compressive strength for the concrete blocks from Oman's market. This study shows 57% difference in the strength by using plastic bottles compared to local concrete blocks. This proves the necessity for further research regarding concrete mix design, amount of cement and properties of local concrete blocks as well as other technical and non-technical aspects to determine the appropriate mix design and feasibility in the production.

Jibrae et al. (2016) This paper presents a method of strengthen concrete by the addition of percentages recycled waste plastic (polyethylene). Almost 126 samples of concrete are prepared, the concrete Strength (compressive, splitting tensile and flexural strength) are investigated along a time interval of 7 to 28 days using 1%, 3% and 5% from fine aggregate recycled waste plastic (polyethylene). It is found that when waste plastic bottles increased from zero to 5% of the sand in the mix, the compressive, tensile and flexural strength of concrete decreased by the ratios of 12.81, 10.71, and increase by 4.1% respectively at 7 days age and also these concrete strength decrease by the ratios 7.93, 28.6, and 23.6% at 28 days age.

III. MATERIAL FOR TESTING

The following materials were used in the experimental work.

A. Cement

In the present investigation, Portland Pozzolona Cement conforming to IS 1489:1991 is used. The total quantity of cement needed for the investigation is obtained in one lot from a fresh stock and without any lumps. The cement is tested Jaypee cement in accordance with the methods of test specified in IS 1489:1991.

1) Aggregates: It should be passed through IS Sieve 4.75 mm. It should be hard, strong, dense, durable and clean. . It confirms to IS 383-1970 which comes under Zone I. Collected from nearby construction. It should confirm to IS 2838(I) and collected from nearby construction.

Fig. 1Fine sand

B. Coarse Aggregates

Fig.2 Aggregate

C. Plastic Fibre

Plastic fibre acts as "secondary reinforcement" in concrete which arrests cracks, increases resistance to impact/abrasion & greatly improves quality of construction in walls, foundations, tanks, roads and pre-cast products like blocks, pipes, tiles, manhole covers, and more. The cut length of plastic fibre is 12 mm is used.

Fig. 3Plastic fibre

D. Water

The water used in the concreting work was the potable water as supplied in the structures laboratory of our college. Water used for mixing and curing was clean and free from injurious amounts of oils, acids, alkalies, salts and sugar, organic materials or other substances that may be deleterious to concrete. As per IS: 456-2000 potable water is generally considered satisfactory for mixing and curing of concrete. Accordingly potable tap water was used for the preparation of all concrete specimens.

E. Super Plasticizer

Super plasticizer of the 'Conplast X421IC' was used for the concrete. Conplast X421IC is non-toxic with IS: 9103: 1999, to minimize permeability and increase the waterproofing properties of concrete water reducing admixture.

IV. TEST RESULTS AND DISCUSSION

The cubes and beams were tested for the compressive strength and for workability test. Various numbers of samples were casted to know the compressive strength and also some sample for workability.

1) *Specific Gravity test:* The ratio of the density of a substance to a density of a standard substance, usually water for a liquid or solid and air for gas. Specific gravity of cement is depending upon the particle size of cement. The test is done as per IS: 2386. The test result calculations are done given below.

Table 1 Specific Gravity of Cement, C.A and F.A

Types of Soil/ Admixture	Specific Gravity
Cement	3.07
Coarse Aggregate	2.7
Fine Aggregate	2.6

A. Elongation index test

Shape test of coarse aggregate is determined by finding out by flakiness and elongation index.

Elongation index = (weight of aggregate whose greatest dimension is more than 1.8 ×mean dimension / total weight of sample) ×100. It is determined by using length gauge.

The test is conducted on fresh aggregate and recycled aggregate of 20 mm.

Elongation index = 15 % for aggregate

Value varies in acceptable limit

B. Workability of Concrete

From the results given in Table 2, it can be seen that the Slump test is high for fresh concrete and it decreases as plastic fibre percentage increases. Variation in slump indicates that some changes occurred in the batching system or mixing system. The apparatus of slump test is simple, portable and suitable for laboratory and on-site testing. After the concrete was fully mixed, the fresh concrete was undertaken for use in the slump test. The test procedure was carried out accordance with IS specifications.

Table 2 Slump Test Result

S/No.	Mix Designation	Percentage of Plastic Fibre	Slump(Mm)
1	MX0	0	70
2	MX1	2	72
3	MX2	4	73
4	MX3	6	68
5	MX4	8	65

The specific surface is increased due to the increased fineness and a greater amount of water is needed for the mix ingredients to get a closer packing, it results in decrease in workability of mix.

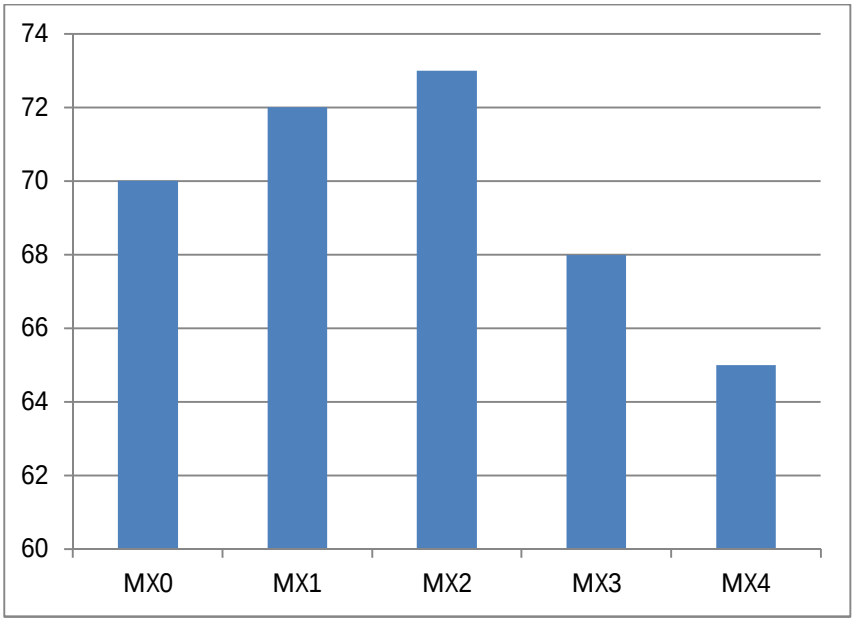

Fig. 4 Graph for Slump Test

C. Compressive Strength

The results of compressive strength with age of concrete with and without plastic fiber in varying proportions are presented in Table 3 & in fig. 5.

Table 3 Compression behavior of Plastic fiber with age

Mix Type	Fiber Content % o	Compressive Strength (f_{ck}) N/mm^2	
		7 days	28 days
M1	0	15.52	20.90
M2	2	16.67	21.96
M3	4	17.16	22.58
M4	6	17.79	22.67
M5	8	16.31	21.29

The compressive strength of all the types of concrete is given in the table 3 and in the figs. 4 at the age of 7 days and 28days. It is observed from the tables that plastic fiber concrete attains the compressive strength at a faster rate than that of plain concrete. M4 plastic fibre concrete at the age of 7 days and 28 days attain high compressive strength.

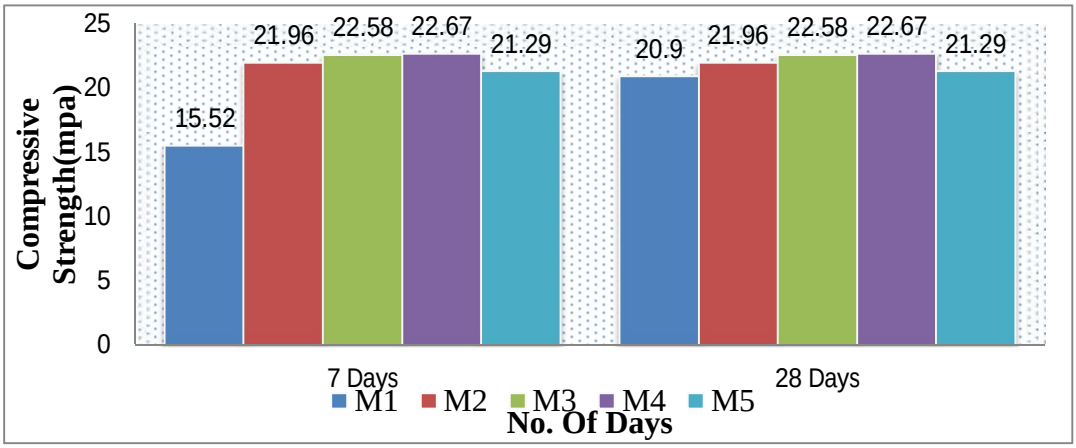

Fig. 5 Graph for Compressive Strength

Plastic fiber concrete containing 0% fiber after 7 days and 28 days was found to be having compressive strength 15.52 N/mm^2 and 20.90 N/mm^2 respectively. Similarly Plastic fiber concrete containing 2 % fiber after 7 days and 28 days was found to be having compressive strength 16.67 N/mm^2 and 21.96 N/mm^2 respectively. A gain in strength with age is observed. Plastic fiber concrete containing 4% fiber after 7 days and 28 days was found to be having compressive strength 17.16 N/mm^2 and 22.58 N/mm^2 respectively. A gain in strength with age is observed. Plastic fiber concrete containing 6% fiber after 7 days and 28 days was found to be having compressive strength 17.79 N/mm^2 and 22.67 N/mm^2 respectively. A gain in strength with age is observed. Plastic fiber concrete containing 8% fiber after 7 days and 28 days was found to be having compressive strength 16.31 N/mm^2 and 21.29 N/mm^2 respectively. A gain in strength with age is observed. Compressive strength of concrete increases with addition of percentage of plastic fiber and plastiszer. Plastic fiber are softer than fine aggregates and it reduce micro crack.

V. CONCLUSIONS

The present work was undertaken to study the effect of cement with plastic fiber (0%, 2%, 4%, 6% and 8%) on cube compressive strength, and flexural strength of concrete for the duration of 7 and 28 days with plasticizer. The conclusions drawn on the basis of this study are as follows:

A. Conclusions

On the basis of the results and discussions on this investigation the following conclusions are drawn:

Early strength was observed in concrete containing plastic fiber after 7 days of curing.

The compressive strength of plastic fiber concrete increased with increase in percentage of plastic fiber content for 2%, 4%, 6% and then gradually decreases with high dosage of 8 %.

The Plastic fiber concrete having 6% plastic fibre content in 28days gives highest compressive strength whereas highest flexural strength is obtained at 6% of plastic fibre content in 28 days.

The workability of concrete increases upto 4 % addition of fibre then it decreases

It can be concluded that concrete containing upto 6% of plastic fiber content showed significant improvement in strength parameter as compared to conventional concrete after more addition there is decrease in strength. Hence concrete can be used upto 6% of plastic fiber content thereby reducing the environmental hazard, and for making the concrete economical can be used 8 %.

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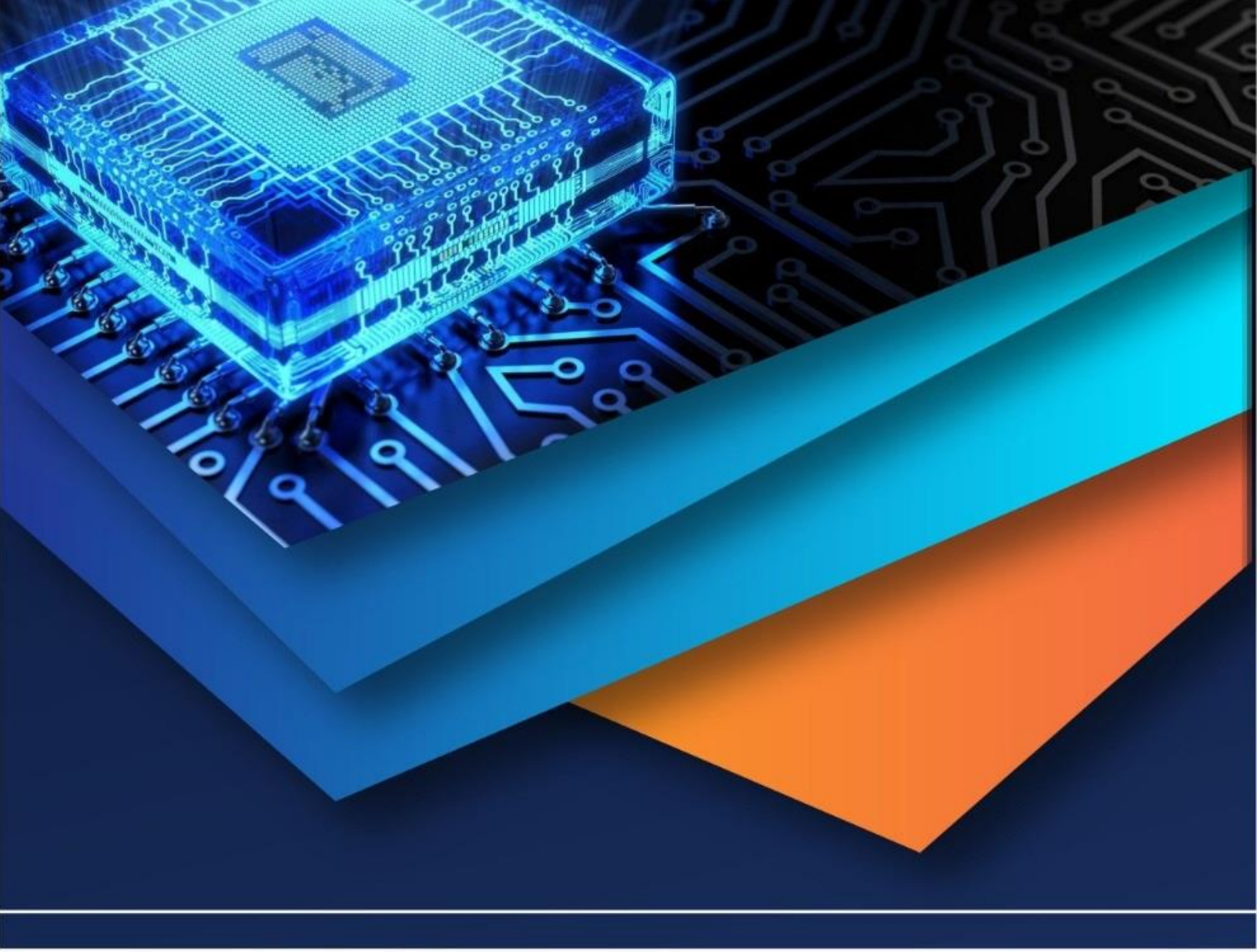

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