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Study on Ordinary Concrete with Waste Plastic as A Fibre

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***Abstract*— In the present investigation we were utilized plastic waste in the concrete. The proposed concrete which is made up by including plastic in concrete may reuse the plastic cover as one of the constituent's material of concrete, to enhance the specific properties of concrete. The sort of plastic utilized is low thickness polythene this plastic waste is utilized as a part of the type of fibre. The properties of concrete as differing rates of plastic (0.2%, 0.4%, 0.6%, 0.8% and 1%) will test for compressive quality, Split rigidity and flexural strength. Plastic waste was changed over in to fibre measure frame and these filaments are not in same group. The numbers of samples are prepared in M30 concrete mix with required water/ cement ratio. Each specimen was cured for 7 days and 28 days. The workability of compression, tension and flexure were carried out. The results are compared with normal concrete was observed.**

***Index Terms*— Waste Plastic, Super Plasticizer, Compressive Strength, Split Tensile Strength and Flexural Strength.**

I. INTRODUCTION

Concrete is the most widely used man-made construction materials in the world. Slightly more than a ton of concrete is produced each year for every human being on the planet. Concrete is a composite material which is made of filler and a binder. Typical concrete is a mixture of fine aggregate (sand), coarse aggregate (rock), cement, and water. Now days the usage of concrete is increasing from time to time due to the rapid development of construction industry. The usage of concrete is not only in building construction but also in other areas such as road construction, bridges, harbour and many more. Concrete does have some limitations despite its numerous advantages. Fundamentally, concrete is economical, strong and durable. Concrete has a relatively low tensile strength, low ductility, low strength-to-weight ratio, and is susceptible to cracking. Thus technology in concrete has been developing in many ways to enhance the quality and properties of concrete.

II. OBJECTIVES

a. To identify various waste materials that can be used in construction industry as one of the ingredients of concrete

b. To assess the compatibility of utilization of waste mat erials in concrete.

c. To study the influence of properties of concrete due to use of plastic waste

d. To promote the utilization of waste materials in concrete for creating a possibility of sustainable construction

e. To motivate engineers and contractors regarding use of waste products in construction thereby paving path for greener environment.

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III. MATERIALCHARACTERIZATION

Introduction

The materials used in this research are cement, fine aggregate, coarse aggregate, water and plastic fibres. They have been tested in laboratory according to Indian standards and presented in this paper.

A. Cement

Cement is binding material which is used for making any type of concrete. Among the various types of cement available in the market, ordinary Portland cement of 53 grade confirming to IS 269-1976, whose compressive strength at the end of 28th day is 54 N/mm^{2}when tested as per IS 4031-1988, from Penna Company is used in the project work. The details of various tests conducted on cements are as follows:

Table 3.1 Results of Tests on Cement

S. NO:	PHYSICAL PROPERTIES	RESULTS
1	Fineness of cement	95%
2	Specific gravity of cement	3.15
3	Normal consistency	33%
4	Initial setting time	35
	Final setting time	600
5	Compressive strength	54 N/mm^2

B. Coarse Aggregate

Aggregates are the vital constituents of the concrete which offer body to the concrete and furthermore lessen shrinkage. Aggregates possess 70 to 80 % of aggregate volume of concrete. We realize that aggregate is gotten from normally happening rocks by impacting or squashing and so forth., along these lines, it is difficult to achieve required shape of aggregate. In any case, the shape of aggregate will influence the workability of concrete. Along these lines, we should take care about the shape of aggregate.

Table 3.2 Physical Properties of Coarse Aggregate

S. NO	PROPERTY	VALUE
1	Specific gravity	2.74
2	Bulk Density	1.670 Kgs/Lit
3	Fineness modulus	8.64
4	Nominal maximum size	20mm

C. FINE AGGREGATE

Those divisions from 4.75 mm to 150 microns are named as fine aggregate. The The river sand and crushed sand is being utilized as a part of mix as fine aggregate adjusting to the prerequisites of IS: 383. The waterway sand is washed and screened to dispense with pernicious materials and over size particles. The fine total should comprise of common sand or other latent materials with comparative properties or combinations having hard, strong durable particles. The utilization of concrete is being obliged by urbanization, zoning regulations, expanded cost and ecological concern.

Table 3.3: Physical Proprties of F.A

S.NO.	PROPERTY	VALUE
1	Specific gravity	2.36
2	Bulk density	1.690 Kgs/lts
3	Fineness modulus	2.84

D. Water

Water is a standout amongst the most vital ingredients in concrete. It assumes a fundamental part being developed of strength in concrete. Hydration of bond in concrete to frame hard gel in charge of strength in concrete is unimaginable without water.

In this project the tap water from the Aditya Engineering College is used for mixing and curing. The physical properties of tap water used in this project are as tabulated in table.

Table 3.4 Physical Properties of Water

S.NO	PROPERTY	VALUE
1	pH	7.1
2	Taste	Agreeable
3	Appearance	Clear
4	Turbidity (NTU)	1.75

E. Plastic Fibres

The plastic fibres used in this research work are of different sizes. These fibres are obtained from waste plastic covers. Plastic covers are cut into fibres by us.

Fig. 1 Plastic Waste Fibre

F. Chemical Admixtures

Admixture is defined as materials, other than cement, water and aggregates, that is used as an ingredient of concrete and it is added to the batch immediately before or during mixing. NAPTHA super plasticizer (Sulphonated Naphthalene Formaldehyde Condensate) is used as chemical admixture in this project.

Fig. 2 NAPTHA Super Plasticizer

Table 3.5 Properties of Naphtha Super Plasticizer

S. No	Property	Value/Specifications
1	Chemical nomenclature	Sulphonated naphthalene Formaldehyde condensate
2	Specific gravity	1.18
3	Chloride content	Nil
4	Recommended dosage	0.6-1.5 lit to the weight of cement
5	Density	7.2 Kg/m^3

IV. MIX DESIGN

The mix design of M30 grade concrete is done according to IS 10262:2009 and the proportions are tabulated below in Table 4.1.

The mix proportioning for a concrete of M 30 Grade with W/C ratio 0.45

Mix proportions

- Cement = 430 Kg/m^3
- Coarse aggregate = 1078 Kg/m^3
- Fine aggregate = 800 Kg/m^3
- Water = 197 Kg/m^3
- Super Plasticizer = 3.5 Kg/m^3

C : F.A : CA
1 : 1.82 : 2.32.

Table 4.1 Mix design for M30 grade concrete with plastic fibres

Mix design	Plastic content	Cement (kg/m3)	F.A (kg/m3)	C.A (kg/m3)	W/C Ratio	Water Content (kg/m3)	Plastic fibre (kg/m3)
M30	0%	430	800	1078	0.45	0.45	0
	0.20%	430	800	1078	0.45	0.45	5.5
	0.40%	430	800	1078	0.45	0.45	11
	0.60%	430	800	1078	0.45	0.45	16.5
	0.80%	430	800	1078	0.45	0.45	22
	1%	430	800	1078	0.45	0.45	27.5

V. RESULTS AND DISCUSSIONS

A. *Compressive Strength Test*

The compressive strength results of M30 grade concrete were discussed in this table. To study compressive strength cubes of 150mm X150mm X 150mm size were casted. These specimens were tested at 7 days and 28 days of curing. Result of compressive strength test was presented in Table.5.1

Table 5.1 Compressive strength of plastic fibre concrete cubes at 7 days and 28 days of curing

% of plastic	Average Compressive Strength in N/mm2	
	7 Days	28 days
0	28.96	38.92
0.2	26.25	37.06
0.4	25.91	37.65
0.6	28.08	38.97
0.8	27.94	38.09
1	23.82	35.68

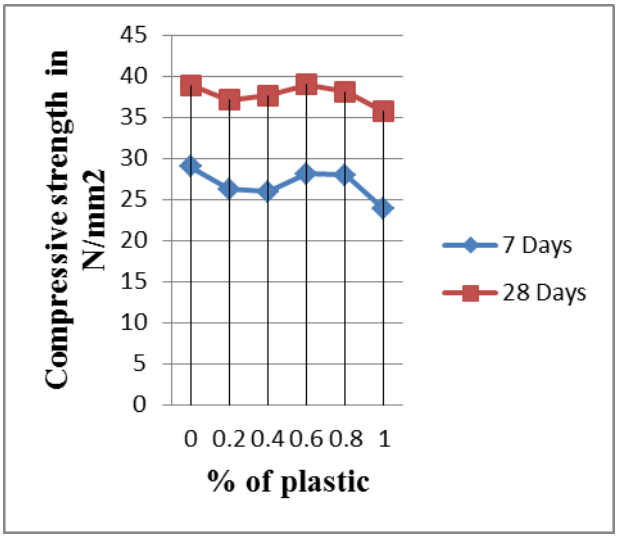

Fig 3 Variation of 7 days and 28 days compressive strength with various percentage of plastic fibre

It was observed that 7 days strength of normal concrete that is with 0% replacement to be 28.96 Mpa and that of plastic concrete to be 28.08 at 0.6%. It was observed that 28 days strength of normal concrete 0% was 38.92 MPa and that of 0.6% plastic concrete was 38.97 MPa. Hence the plastic concrete has attained same strength without any effect of properties of normal concrete.

B. *Split Tensile Strength*

Tensile strength is one of the essential and critical properties of concrete. Concrete is great in compression but weak in tension and this is one of the drawbacks of concrete. Split rigidity test were completed on a cylinder shaped specimen 150 mm diameter and 300 mm long. Specimen should be tested following 7 and 28 days individually. Result of split tensile test was presented in Table.5.2

Table 5.2 Split tensile strength of plastic fibre concrete cubes at 7 days and 28 days of curing

% of plastic	Average split tensile Strength in N/mm2	
	7 Days	28 days
0	3.16	4.95
0.2	3.6	5.18
0.4	3.83	5.35
0.6	4.07	5.51
0.8	4.35	5.81
1	4.68	5.52

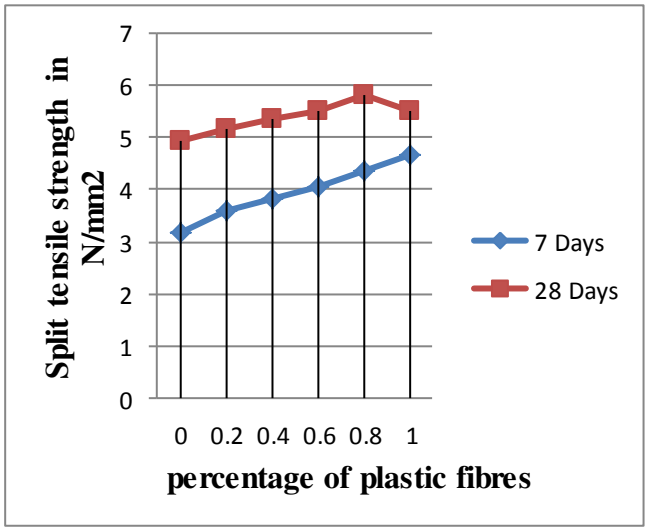

Fig 4 Variation of 7 days and 28 days split tensile strength with various percentage of plastic fibre

It was observed that 7 days split tensile strength of normal concrete with 0% was found to be 3.16 Mpa and that of 1% plastic concrete was 4.68 with increment of 32% .

For 28 days split tensile strength of normal concrete with 0% replacement was found to be 4.95 Mpa and that of 0.8% plastic concrete was 5.81 Mpa with increment of 14% .

From the above, it is observed that adding plastic up to 0.8%, the tensile strength increases beyond that increase of plastic % decreases the tensile strength**.**

C. Flexural strength

Flexural strength is a measure of the tensile strength of concrete beams or slabs. Flexural strength identifies the amount of stress and force an unreinforced concrete slab, beam or other structure can withstand such that it resists any bending failures. Flexural strength is also known as bend strength or modulus of rupture or fracture strength.

Flexural strength test were completed on a beam specimen 150x150x500 mm size. Specimen should be tested following 7 and 28 days individually. Result of flexural strength test was presented in Table.5.3

Table 5.3 Flexural strength of plastic fibre concrete cubes at 7 days and 28 days of curing

% of plastic	Average Flexural Strength in N/mm2	
	7 Days	28 days
0	4.15	6.25
0.2	4.33	6.4
0.4	4.45	6.55
0.6	4.68	6.89
0.8	4.38	5.97
1	4.25	5.69

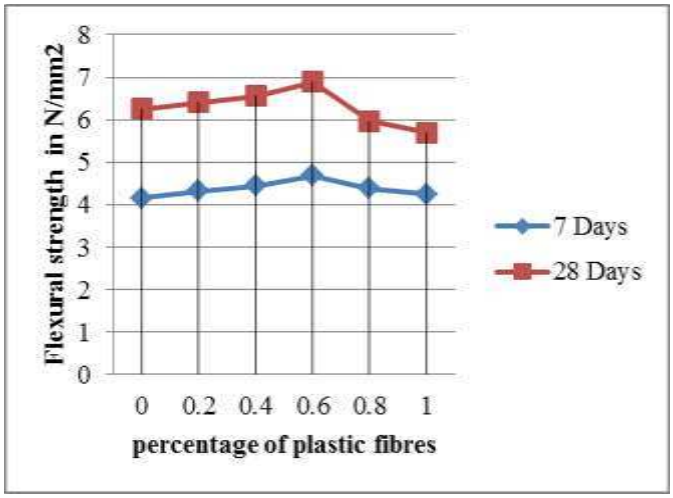

Fig 5 Variation of 7 days and 28 days flexural strength with various percentage of plastic fibre

For 7 days flexural strength of normal concrete with 0% replacement was found to be 4.15 MPa and that of 0.6% plastic concrete was 4.68 MPa with increment of 11%.

For 28 days flexural strength of normal concrete with 0% replacement was found to be 6.25 MPa and that of 0.6% plastic concrete was 6.89 MPa with increment of 9 %.

VI. CONCLUSIONS

Based on the Experimental result following points are summarized with regard to Experimental study on mechanical properties of concrete by waste plastic.

1. Compressive strength of concrete is influenced by expansion of plastic strands and it continues diminishing as the level of plastic builds expansion of 1 % of plastic in concrete causes around 20% lessening in quality following 28 days curing.
2. The split elasticity perception demonstrates the change of rigidity of concrete up to 0.8 % of plastic change of quality recorded after that expansion of quality of concrete decreases with expansion of plastic.
3. The flexural strength is observed that strength of concrete shows increasing as the percentage of plastic up to 0.6 and beyond the 0.6% the strength will decreases.
4. From the result, it is observed that the compressive strength and flexural strength has increased at the percentage of plastic is added 0.6.beyond that the strength will decreased.
5. The split quality has been increased along the increasing percentage of plastic content.
6. From the above discussion, this type of plastic concrete is also used for making pavement constructions.
7. It is identified that the utilization of plastic can be conceivable to enhance the properties of concrete which can go about as a one of the plastic transfer technique.
8. It makes the concrete light weight.
9. Utilization of Waste plastic in concrete eradicates the disposal of the plastic waste, thereby paving way for greener concrete.
10. It is economical and is free of cost.
11. Utilization of waste plastic in concrete minimizes the pollution of land, water and air.
12. From this project, it is observed that the optimum percentage of plastic added to the concrete between 0.6 to 0.8 for getting good strength.
13. It is possible to add mineral admixtures to improve the properties of concrete along with chemical admixtures.
14. This type of plastic concrete is also used for rigid pavements in rural areas for economical construction.

VII SCOPE FOR FUTURE WORK

In regard to the project entitled **"STUDY ON ORDINARY CONCRETE WITH WASTE PLASTIC AS A FIBRE**", following things can be taken in consideration in the future

1. There is a scope to use different chemical admixtures like polycarboxylate in concrete which may improve properties like workability, compressive strength, tensile strength and durability etc. in future.

2. Different water cement ratios other than applied in this project can be tested.
3. Waste plastic fibres of different sizes range other than used in this project can be used and research can be carried out.
4. Study of plastic as one of the alternative materials as replacement of fine aggregate and coarse aggregate in concrete can be studied and tests can be carried out.
5. Effective curing methods like steam curing can be used with the help of adding admixtures which could reduce shrinkage and creep and also to maintain good quality control throughout concrete element.
6. There is a scope of study of different fibres like plastic, steel, adding of both in concrete produces better results for compression, tensile strength and flexural strength.

REFERENCES

[1] R.Lakshmi, S. Nagan, "Utilization of waste E plastic particles in cementitious mixtures" Journal of Structural Engineering,Vol.38, No. 1, April – May 2011, pp. 26- 35.
[2] P.Muthupriya, K. Subramanian, B.G. Vishuram, "Experimental investigation on high performance reinforced concrete column with silica fume and fly ash as admixtures" Journal of Structural International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974 IJAERS/Vol. I/ Issue III/April-June, 2012/109-111 Engineering,Vol.38, No. 1, April – May 2011, pp. 46- 59
[3] Dr. M. Sivaraja "Application of coir fibers as concrete composites for disaster prone structures" submitted to Central Institute of Coir Technology.
[4] K. Soman, Divya Sasi, and K.A Abubaker, "Strength properties of concrete with partial replacement of sand by bottom ash," International Journal of Innovative Research in Advanced Engineering (IJIRAE), ISSN: 2349-2163, Volume 1 Issue 7 (August 2014).
[5] Ganesh Tapkire,Satish parihar,Pramod Patil,Hemraj R Kumavat," Recycled plastic used in concrete paver block," International Journal of Research in Engineering and Technology Volume: 03 Special Issue:09 June 2014.
[6] Nitish Puri, Brijesh Kumar, Himanshu Tyagi," Utilization of Recycled Wastes as Ingredients in Concrete Mix," International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 22783075, Volume- 2, Issue-2, January 2013.
[7] Adnan Flayih Hassan Al-Sibahy, "Thermo-mechanical behaviour of a novel lightweight concrete and its application in masonry walls," 2012 Doctor of Philosophy, The University of Manchester.
[8] Gurpreet singh, A thesis on "strength and durability studies of concrete containing waste foundry sand," Thapar university.
[9] Ali J. Hamad, "Materials, Production, Properties and Application of Aerated Lightweight Concrete" International Journal of Materials Science and Engineering Vol. 2, No. 2, December 2014.
[10] **WWW.Civil engineering.com**
[11] **WWW.Wikipedia.com**