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Replacement of Sand with Shredded Plastic in Cement Concrete

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***Abstract*— The concrete is the second largest material using on earth after water. In India, approximately 400 million metric cube concrete is being used every year and is increasing day by day. This increase in demand will create disturbance in proportion between availability and need of material. Hence an alternative material is required to vanishing this disturbance. In this paper studies conducted on utility of waste shredded plastic material used in the concrete. Moreover this paper will focus toward the change in various properties of concrete when partially replacing with shredded plastic. Concrete with 0.5%, 1.0%, 2%, 4% and 6 % shredded plastic is prepared. Specific gravity, fineness, setting time, sieve analysis, fineness modulus tests on cement, coarse and fine aggregates are performed in this study. As per IS 10262-2009 mix design code, Mix design is done. Cubes and beams are cast for M20 grade concrete with and without shredded plastics and tests on concrete are conducted. The standard mechanical properties of concrete like compressive strength, flexura land strength are tested and compared with the results of standard specimen. Higher compressive and flexural strength were observed on 4 % replacement of fine aggregate with shredded plastic.**

Keywords*— *Fine aggregate, Shredded plastic, replacement, Compressive strength, Flexural strength

INTRODUCTION

Concrete is the most widely used man made construction material in the world and its second only to water as the most utilized substance in the planet. Seeking aggregates for concrete and to dispose of the waste from various commodities is the present concern. Today sustainability has got top priority in construction industry. In the present study the shredded plastics were used to prepare the coarse aggregates thereby providing a sustainable option to deal with the plastic waste. So these plastics will end up as earth fill. In this circumstance instead of recycling it repeatedly, if it is utilized to prepare aggregates for concrete, it will be a boon to the construction industry. Most of the failures in concrete structures occur due to the failure of concrete by crushing of aggregates. PCAs which have low crushing values will not be crushed as easily as the stone aggregates. Due to rapid industrialization and urbanization in the country lots of infrastructure developments are taking place. this rapid development led to the acute shortage of construction materials, increased dumping of waste materials. Hence to overcome the above said problems waste products should be employed as a construction material. Fine aggregate used in concrete is replaced partially by shredded plastic in known percentages and properties are tested, the optimum percentage at which higher strength is obtained is calculated. Considerable researches were carried out in some countries like USA, UK on this topic however there have been very limited studies on plastics in India.

RESEARCH SIGNIFICANCE

Shredded plastic which is waste after use and create environmental problems. Large amount of plastic waste produced every year. Recycle and reused of plastic require vast manpower and processing cost thus the very small amount of plastic recycled and reused and rest going into landfills, incinerators and dumps. Here author suggested the use of these plastic pieces in a concrete as a plastic fibre to improve the properties of concrete. Use of plastic has a dual advantage cost of material is low also it solve the problem of disposal of plastic up to some extent.

OBJECTIVE OF THE STUDY:

As the concrete is the second largest material using on earth after water. In India, approximately 400 million metric cube concrete is being used every year and is increasing day by day. This increase in demand will create disturbance in proportion between availability and need of material. Hence an alternative material is required to vanishing this disturbance. In this study shredded waste plastic is used as a alternative material. Following are the objectives of this study.

a. Effective use of shredded waste plastic.
b. To study the effect of shredded plastic on compressive strength of concrete.
c. To study the effect of shredded plastic on flexural strength of concrete.

MATERIALS:

CEMENT: **O**rdinary Portland cement grade - 43 was used for the test. Which is confirming to IS 8112- 1989.

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Table:1.1 Properties of cement:

Physical Properties	**Test Results**	**As per IS 8112-1989**
Standard Consistency	29%	-
Initial setting time	47 min.	Minimum 30 min.
Final setting time	430 min.	Maximum 600 min
Specific gravity	3.3	-

SAND: IS 2386 (Part-1), Natural river sand is used in the test for which reading is given below.

Table: 1.2 Properties of sand:

Physical Properties	**Test Results**
Fineness Modulus	2.77
Water absorption	0.62%
Specific Gravity	2.68
Free moisture content	0.15%

Course Aggregates: IS 2386 (Part-III), Crushed stone aggregate were used.

Table: 1.2 Properties of Course Aggregate:

Physical Properties	**Test Results**
Fineness Modulus	2.92
Water absorption	0.40%
Specific Gravity	2.62
Free moisture content	0.1%
Aggregate impact Value	13%
Aggregate crushing value	23%

Water: Potable water As per IS 456-2000 was taken for the casting and curing process in the study.

Plastic: Shredded Plastic is used in replacement of sand from the cement concrete to use the waste products from factory.

Figure 1.1: Shredded Plastic

Concrete mix: All mixes prepared are for M20 concrete and 0.45 water-cement ratio.

Table 1.3 Materials for Shredded Plastic

S.no	Material	.5%	1%	2%	4%	6%
1.	Cement	4.540 kg	4.540 kg	4.540 kg	4.540 kg	4.540 kg
2.	Fine Aggregate	6.742 kg	6.708 kg	6.64 kg	6.504 kg	6.368 kg
3.	Coarse Aggregate	13.500 kg	13.500 kg	13.500 kg	13.500 kg	13.500 kg
4.	Shredded Plastic	34 gm	68 gm	136 gm	272 gm	408 gm

Table 1.4 Compressive Strength Test With Shredded Plastic:

S.no.	Percentage of shredded plastic	Quantity of Plastic (in gm)	Curing 3 days (in KN)	Curing 7 days (in KN)	Curing 28 days (in KN)
1.	0%	0%	8.28	15.20	20.10
2.	.5%	34	8.56	18.20	21.48
3.	1%	68	13.22	18.45	21.50
4.	2%	136	12.87	14.22	21.85
5.	4%	272	12.25	13.91	23.19
6.	6%	408	8.48	9.16	17.72

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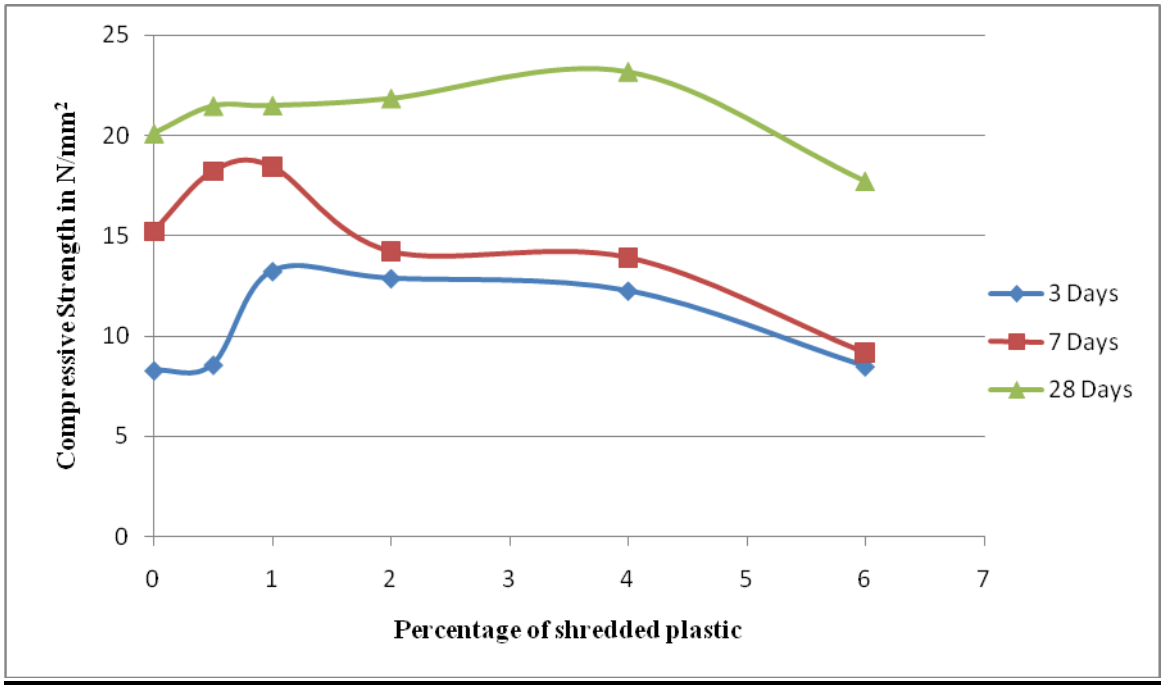
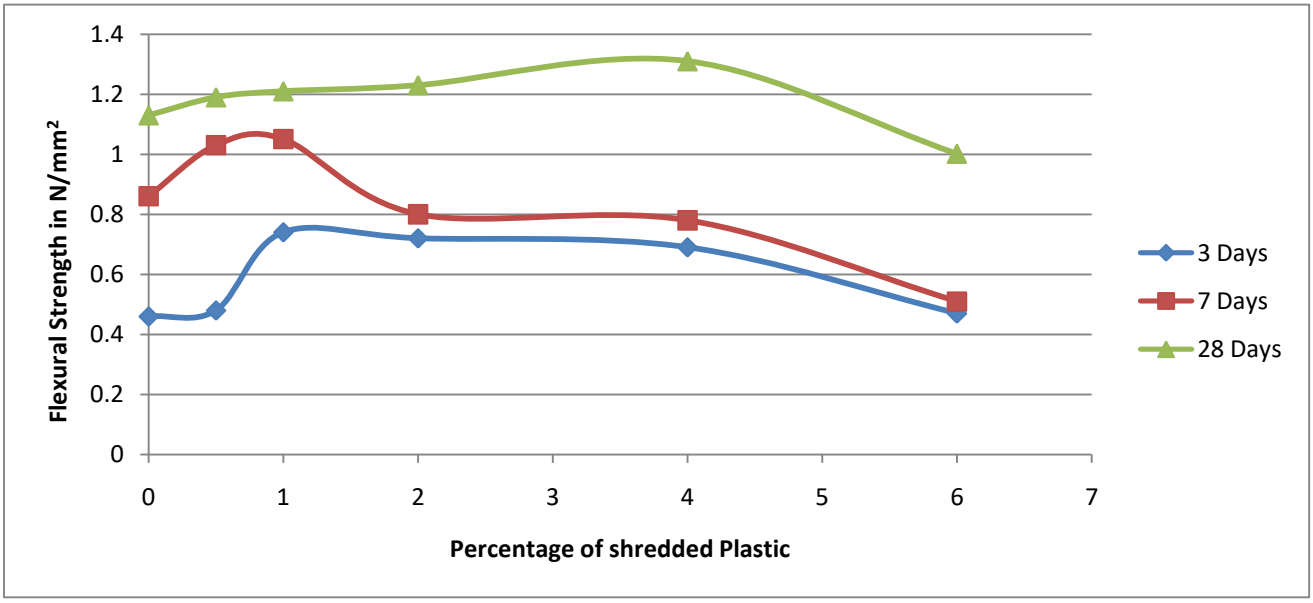


FLEXURAL STRENGTH:

S.no.	Percentage of shredded plastic	Curing 3 days (in KN)	Curing 7 days (in KN)	Curing 28 days (in KN)
1.	0%	0.46	0.86	1.13
2.	.5%	0.48	1.03	1.19
3.	1%	0.74	1.05	1.21
4.	2%	0.72	0.8	1.23
5.	4%	0.69	0.78	1.31
6.	6%	0.47	0.51	1.002



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CONCLUSIONS:

1. Shredded waste plastic effectively can be used in concrete without compromising with strength.
2. Maximum compressive strength is observed at addition of 4% of shredded plastic in concrete. Furthermore addition will lead to decrease in compressive strength after 28 days of proper curing.
3. It is observed that addition of 0 to 2% shredded plastic does not make any considerable change on 28 days compressive strength of concrete.
4. Maximum flexural strength is also observed at addition of 4% of shredded plastic in concrete. Furthermore addition will lead to decrease in flexural strength after 28 days of proper curing.

FUTURE SCOPE:

1. Split tensile strength of can be checked with the same proportion of shredded waste plastic.
2. Durability of concrete can be checked with the same proportion of shredded waste plastic.
3. Amount of shredded plastic can be increase with addition of admixtures in further studies.

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