Mechanical Properties on Recycled Plastic Waste As Partial Replacement For Fine Aggregate In Concrete

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Abstract- *Concrete is combination of cement, M sand, aggregate and water. Due to enormous growth in concrete technology in aggregate are facing crisis. Apart from this growth of plastic has provided the methods to solve environmental issue caused by plastic. We have made an experiment by partially replacing fine aggregate with plastic an investigation has been carried out. The strength properties of M30 grade concrete are noticed with different plastic percentage proportions.*

PVC(Poly Vinyl Chloride) pipe plastic added proportions are 5%,10%,15% and 20% by volume .We noticed mechanical properties of these mixes. There is decrease in compressive strength when the ratio of plastic to aggregate was increased. We have taken the mix for which compressive strength was least and to that mix we have partially replaced cement with silica fume. The strength properties were again noticed, It was noticed that when cement was partially replaced by 5%, 10%, 15% and 20% of silica fume used was higher than reference mix.

Keywords- PVC Plastic waste, silica fume, Compressive strength, Split tensile strength, Flexural strength

I. INTRODUCTION

The most problematic plastic produced today is polyvinylchloride or PVC, commonly called vinyl. World production of PVC today is at more than 20 million tonnes per year up from 3 million tonnes in 1965 which corresponds to about one fifth of the total plastic production. For years throw away product made of PVC have been a leading causes of dioxin in incineration and when burned in fires.

As more PVC is being disposal of we are now seeing the first stages of an impending PVC waste mountain with no safe way to disposal of it and with little hope it will be recycled. Considering life spans of about 30 years and more, a significant increase of PVC waste quantities is expected to start around 2010. The trouble is there is no safe way to deal with this inherently hazardous waste materials in india, the collection transportation and disposal of solid waste are waste are unscientific and chaotic. Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfill, which have serious environmental implication in terms of ground water pollution and contribute to global warming.

II. METHODOLOGY

This project follows the steps given below:

- Collection of literature.
- Test and study the material properties required for making a concrete.
- Mix proportioning of concrete (M_{30}).
- Preparation of concrete specimen tested for an age of 7days, 14 days and 28 days.
- Investigation of strength parameter like Compressive strength, Split tensile and Flexural strength of conventional reinforced concrete Vs Special concrete made by Plastic waste and silica fume.

III. MATERIAL PROPERTIES

3.1 CEMENT TEST:

Table 1 – Cement Test

S.NO	TEST	RESULT
1	Standard consistency test	28%
2	Specific gravity test	2.89
3	Fineness test	9%
4	Initial setting time	30min
5	Final setting time	9hr 22min

3.2 FINE AGGREGATE TEST (M-sand)

Table 2 – Test on Fine aggregate

S.NO	TEST	RESULT
1	Specific gravity test	2.62
2	Sieve analysis test	2.40

3.3 COARSE AGGREGATE TEST:

Table 3 – Test on Coarse aggregate

S.NO	TEST	RESULT
1	Sieve analysis test	16.05
2	Impact strength test	20.21%
3	Crushing strength test	32.17%
4	Abrasion test	20.76%
5	Elongation index test	13.13%
6	Flakiness index test	14.32%

3.4 TEST ON FRESH CONCRETE:

Table 4 – Test on Coarse aggregate

S.NO	TEST	RESULT
1	Slump cone test	75mm
2	Compaction factor test	0.95

IV. EXPERIMENTAL INVESTIGATION ON HARDENED CONCRETE

1. Compressive Strength test
2. Split Tensile Strength test
3. Flexural Strength test

Compressive Strength Test

Compressive strength is one of the important properties of concrete. Concrete cubes of size 150x150x150mm were cast with and without rubber. After 24 hours the specimen were demoulded and subjected to water curing. After 7, 14 and 28 days of curing, the three cubes were taken and allowed to dry and tested in compressive strength testing machine.

Split Tensile Strength:

Tensile strength is indirect way of finding the tensile strength of concrete by subjecting the cylinder to compressive force. Cylinder of size 150mm diameter and 300 mm long. After 24 hours the specimen were demoulded and subjected to water curing. After 7,14 and 28 days of curing, the three cylinders were taken and allowed to dry and tested in spilit tensile strength strength testing machine.

Flexural Strength:

To determine the flexural strength of concrete of beam of size 4000x100x100mm were cast with and without rubber. After 24 hours the specimen were demoulded and subjected to water curing. After 7,14 and 28 days of curing, the curing three beams were taken and allowed to dry and tested in UTM.

V. RESULTS AND DISCUSSION

5.1 Compressive strength

Table 5 - Compressive strength

S.No	REPLACEMENT BY PLASTIC WASTE (%)	REPLACEMENT BY SILICA FUME (%)	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
1	5%	5%	18.63	23.34	26.88
2	10%	10%	18.31	21.50	30.60
3	15%	15%	19.88	22.66	35.30
4	20%	20%	17.43	20.19	25.60

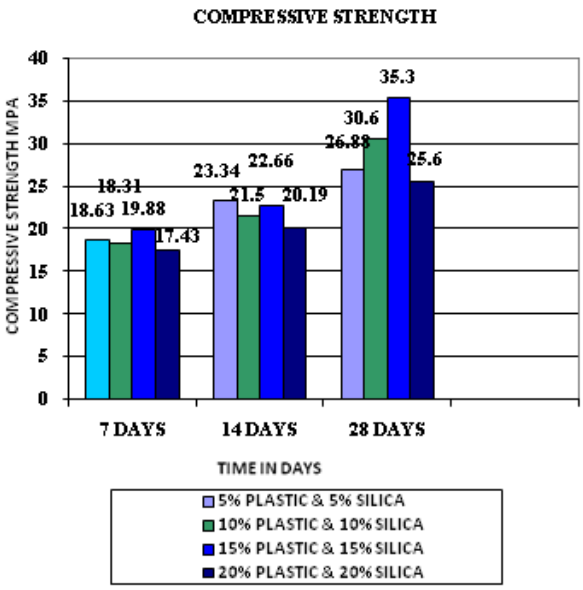

Fig .1 compressive strength of concrete

Table 6- Split tensile strength test: (cylinder)

S.No	REPLACEMENT BY PLASTIC WASTE (%)	REPLACEMENT BY SILICA FUME (%)	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
1	5%	5%	1.66	1.98	2.22
2	10%	10%	1.89	1.96	2.81
3	15%	15%	2.39	2.72	2.98
4	20%	20%	1.72	1.86	2.49

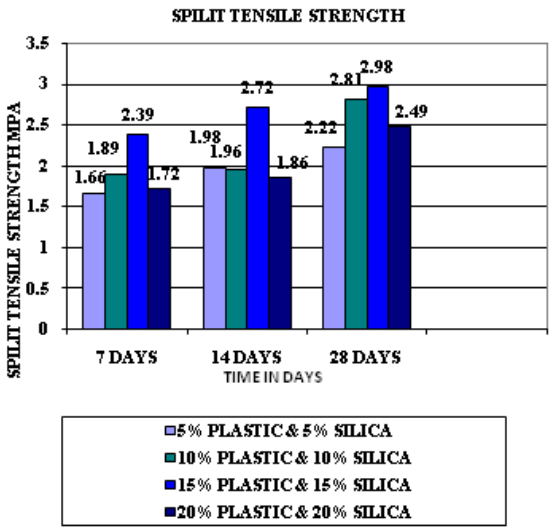

Fig.2 Split tensile strength

Table 7- Flexural strength

S.No	REPLACEMENT BY PLASTIC WASTE (%)	REPLACEMENT BY SILICA FUME (%)	7 DAYS N/mm^2	14 DAYS N/mm^2	28 DAYS N/mm^2
1	5%	5%	12.87	13.67	14.23
2	10%	10%	11.66	13.55	15.19
3	15%	15%	13.56	15.56	16.17
4	20%	20%	11.13	12.68	13.72

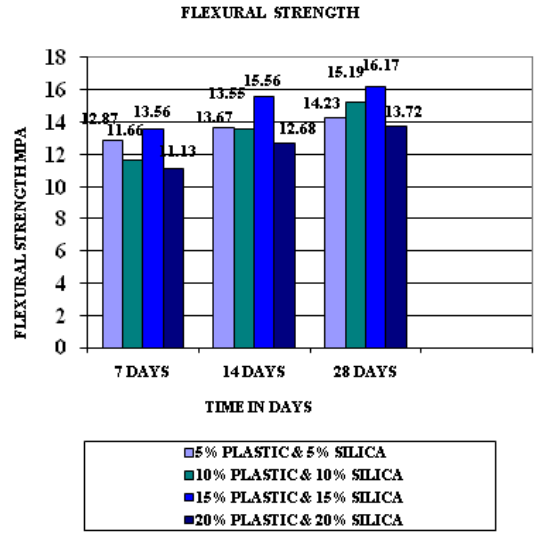

Fig. 3 Flexural strength

VI. CONCLUSION

- After the completion of all tests it was observed that the mechanical properties, micro structural properties of the concrete of the concrete.
- The compressive strength of the specimens increased after an increase in curing time. The maximum compressive strength were observed with the concrete of 5 %, 10 %, 15 % and 20 % plastic waste and 5%, 10 %, 15 % and 20 % inhibitor added concrete.
- The concrete for M30 grade have a nominal compressive strength is 30 N/mm, Replacement of M sand by plastic waste material in 20% and 40% increase in the compressive strength of concrete up to acceptable limit.
- The strength of the concrete higher than the nominal concrete.
- We have enhanced it by using a partial replacement to cement of silica fume by 5%,10%,15%. The mix in which 15% of silica fume is used has binder the compressive strength increased by 5% when compared the nominal concrete mix
- By using recycled waste plastic in concrete can reduce the land fill and environmental issues

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