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USE OF PLASTIC FIBRE IN CONCRETE

(Addition and Replacement of Plastic Fibres with fine Aggregate)

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***Abstract*- Plastic bags which are commonly used for carrying vegetables, meat and daily needs create massive amount of environmental problems around. Instead of deducting its use research says that people have started using it on a greater amount as compared to past. Many efforts were made to minimize the use of plastic but there were no effective results. On the contrary, concrete making came across short of construction materials and that is why many experiments were made to check the feasibility of plastic components as a construction material. The Tensile strength of the concrete can be increased by addition of plastic fibre (hard) of length 4cm and breadth 3mm which is readily available in the market. The tests were carried out by adding plastic fibre by 0.5%, 1%, 1.5%, and 2%of weight of cement. We have also replaced fine aggregate with cement and tests such as workability test, slump test, tests based on strengths and ductility were carried out. After carrying varied tests on concrete with plastic as an admixture we came across some results showing improvement in tensile strength as compared to conventional concrete, whereas it shows reduction in compressive strength than conventional concrete. In order to minimize the reduction in compressive strength we have used Calcium Chloride as an admixture. As there are some benefits behind using plastic as a construction material it has been widely adopted, although cost for cutting the plastic components into plastic fibres is bit high.**

I. INTRODUCTION

Plastic waste is one the fastest growing waste in India. Areas around slum places are generally found as dumping and incineration spots creating air, water, and soil and food pollution resulting into numerous diseases in people with residence around. Instead of using these methods if eliminating waste through flowing water and finall y dumping into sea water is adopted it usually ends up with fatal results of aquatic animals.

That is why, there's need of finding some other way to destroy the plastic waste. Thinking about recycling the plastic waste it clearly visualizes the hike in cost and manpower required to proceed with the process. Many other ideas came into existence for decomposition of plastic wastes like using plastic as manure, manufacturing material in Pipes etc. It was also adopted as one the material used in construction of bitumen roads and it is still in practice. But, the best use man could find for decomposition of plastic is itsapplication in concrete as an admixture or a replacement to fine aggregate.

As stated, it increases tensile strength of concrete and also improves its flexural strength when spaced closely to each other. These plastic fibres obstruct the micro cracks delaying the propagation of cracks and eventually increasing its tensile strength.

According to research plastic generally takes 1000 years to degrade which is quite an effective span for polluting the surrounding. Hence it is better to make use of plastic waste as a construction material in concrete rather than degrading it. With the use of plastic in concrete natural resources that cannot be replenished are saved and sustained. It also helps to save and recycle energy production processes.

II. PROPERTIES OF MATERIALS

Plastic-Plastic is a material made up of polymers such as polyethylene, nylon etc. that can be moulded into shapes when it is soft in nature. They are used for packing, carrying things and in regular needs. The length of plastic fibre was kept 4cm and breadth was 3 mm. According to survey plastic bag production is 500 billion worldwide.

Portland Pozzolana Cement - It is a cement made by blending or grinding of OPC clinker, gypsum and pozzolanic material separately. It is a natural or artificial material containing silica in a reactive form. It reacts with calcium hydroxide in presence of water at ordinary temperature to form compounds possessing cement properties. It has its application in marine, mass concreting and hydraulic structures. The grade of PPC cement defines its compressive

strength in MPa. It saves 8-10% of cement in comparison to other convenient.

TABLE 1(Properties of Cement)

S.N.	PHYSICAL PROPERTIES	TYPICAL RANGE	REQ OF IS:1489(part1) 1991
1.	Fineness (M2/kg)	340-360	300 Min.
2.	Setting time(minutes)		
	Initial	180-220	30 Min.
	Final	220-240	600 Max.
3.	Compressive Strength (MPa)		
	3 days	24.0-26.0	16 Min.
	7 days	34.0-36	22 Min.
	28 days	48.0-52.0	33 Min.

Coarse Aggregates- Aggregate whose particles do not pass through 4.75 mm IS sieve are termed as coarse aggregates. The maximum size of coarse aggregate used in a concrete depends upon grade of concrete to be formed. Types of coarse aggregates are crushed stones, gravels etc

TABLE 2(Properties of Coarse Aggregate)

Physical Properties	Test Results
Specific Gravity	2.6
Fineness Modulus	2.98
Water Absorption	0.5%
Free Moisture Content	0.1%

Water- Water which is free from impurities and salts are generally used for casting and curing the concrete blocks as per IS456-2000.

Fine Aggregate- Aggregate whose particles pass through 4.75 mm IS sieve are termed as fine aggregates. Fine aggregates, because of its binding and griping properties distribute the load acting over a concrete element uniformly across length. It also acts as a tension member.

TABLE 3(Properties of Fine Aggregate)

Physical Properties	Test Results
Specific Gravity	2.65
Fineness Modulus	2.8
Water Absorption	0.65%
Free Moisture Content	0.2%

III. METHODOLOGY

The strips of plastic are obtained from the shop and arranged in layers in between the concrete according to the calculated percentages. The percentage of addition of plastics was varied from 0.1% to 1% by weight and the specimens were cast. The cast specimens were cured for 7 days, 14 days and 28 days. The mix proportion used in the present investigation was 1:1.5:3 with water cement ratio of 0.5. The ingredients of the concrete viz. cement, sand and aggregate were weighed and mixed dry. To this dry mix the calculated quantity of plastic were added and the mixing was continued till a homogeneous mix was obtained. Then the calculated quantity of water was added and again mixed thoroughly. The specimens cast were cubes of size 150x150x150mm. The cast specimens after curing were subjected to compression testing.

TESTING PROCEDURE- The specimens were placed on the Universal Testing machine. The dial gauges were placed on the specified locations. Strain readings were taken. Load was applied on the specimen gradually. Strain reading and deflections were noted at predetermined load levels. The load was applied continuously till the failure of the specimen takes place. The type of failure was noted down carefully.

COMPRESSIVE STRENGTH TEST- Compressive strength test were carried out on 150mm X 150 mm X 150 mm specimen for that three cube were prepared for each mix. Strength of each cube was evaluated after 7, 14 and 28 days respectively. Test was carried out as per IS 14858:2000.

TENSILE STRENGTH TEST- Tensile strength test were carried out on 150mm diameter & 300mm heighted specimen for that three cylinder were prepared for each mix. Strength of each cylinder was evaluated after 7, 14 and 28 days respectively. Test was carried out as per IS 14858:2000

IV. FACTORS AFFECTING PLASTIC CONCRETE

Size of Aggregates- 60-80% of volume of concrete is occupied by aggregates that are coarse and fine. Hence aggregates affect the properties of concrete i.e. physical, thermal and chemical properties. Hence, it influences the performance of concrete to greater extent.

Water-Cement Ratio- Water cement ratio is the most important indicator of strength. Lower the water cement ratio higher will be the final concrete strength. The concept of water cement ratio was developed by Duff Abrams.

Volume of Plastic Fibres-

Low volume fractions (less than 1%) - Used in slabs and pavements that have large exposed surface leading to high shrinkage and cracking.

Moderate volume fractions (between 1-2%) - Used in construction methods such as shotcrete and structure requiring resistance against fatigue. High volume fractions (greater than 2%) - Used in making high performance fibre reinforced composites.

V. RESULT AND CONCLUSION

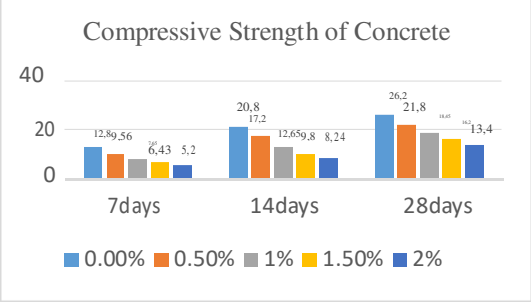
5.1.*ON ADDITION OF PLASTIC FIBRE*

The Plastic fibres are added about 0.5% to 1% by weight of cement and compression and tensile test were carried out.

5.1.1 Compressive strength

Compressive Strength were carried out on 150 mm X 150 mm X 150 mm specimen for that three cube were prepared for each mix. Strength of each cube was evaluated after 7, 14 and 28 days respectively. Test was carried out as per IS 14858: 2000 as shown in table 5.1.1

Table 5.1.1 Compressive Strength Test Results (N/mm2)

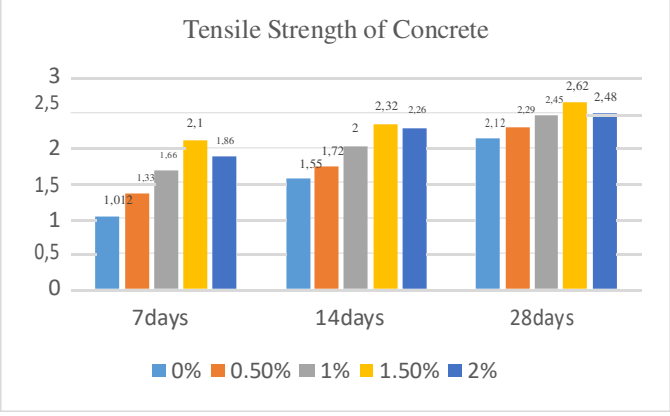


5.1.2. Tensile Strength

The 7 days, 14 days and 28 days tensile strength results were recorded. As shown in the table 4.2 the tensile strength of concrete goes on increasing with increase in percentage of plastic pieces as shown in table 5.1.2

. Table 5.1.2 Tensile Strength Test Results (N/mm2)

Percentage of Plastic	0.0 %	0.50 %	1.00 %	1.50 %	2.00 %
7 days	1.012	1.33	1.66	2.10	1.86
14 days	1.55	1.72	2	2.32	2.26
28 days	2.12	2.29	2.45	2.62	2.48



Percentage of Plastic	0.0 %	0.50 %	1.00%	1.50 %	2%
7 days	12.8	9.56	7.65	6.43	5.2
14 days	20.8	17.2	12.65	9.8	8.24
28 days	26.2	21.8	18.45	16.2	13.4

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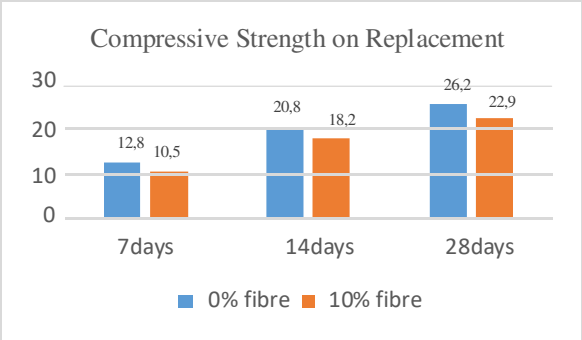
5.2 ON REPLACEMENT OF FINE AGGREGATE BY PLASTIC FIBRE

5.2.1 Compressive Strength - When fine aggregate is replaced with plastic fibre the compressive strength goes on reducing with increment of plastic fibre in it. The compressive strength is reduced approximately by 10% with replacement of 10% plastic fibre and goes on reducing with increment in quantity of plastic fibre as shown in table 5.2.1

Table 5.2.1 Compressive Strength Test Results (N/mm2)

Percentage of Plastic	0.0%	10%
7 days	12.8	10.5
14 days	20.8	18.2
28 days	26.2	22.9

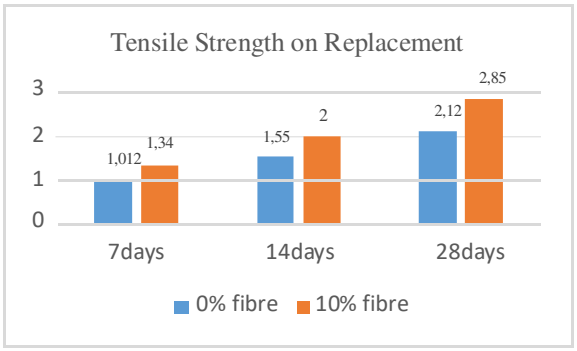


5.2.2 Tensile Strength

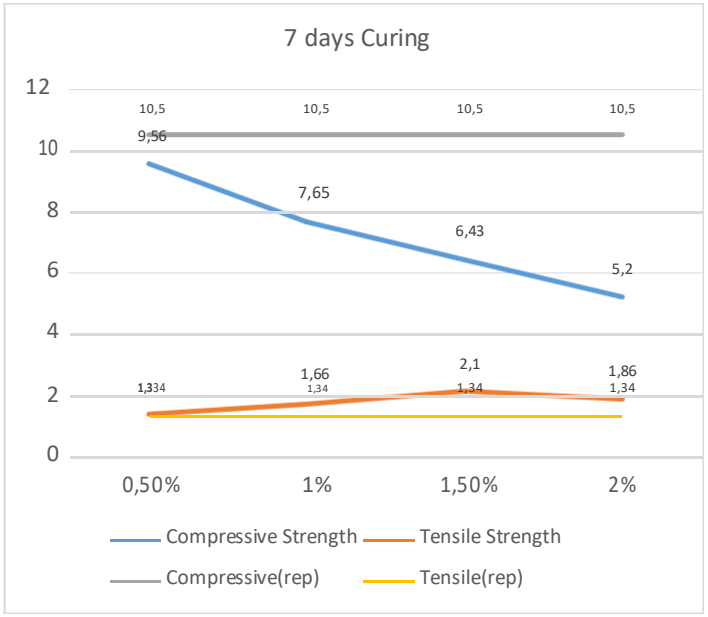
When fine aggregate is replaced with plastic fibre the tensile strength goes on increasing with increment of plastic fibre in it. The tensile strength is increased approximately by 35% with replacement of 10% plastic fibre and goes on increasing with increment in quantity of plastic fibre to a particular extent and after that it reduces as shown in table 5.2.2

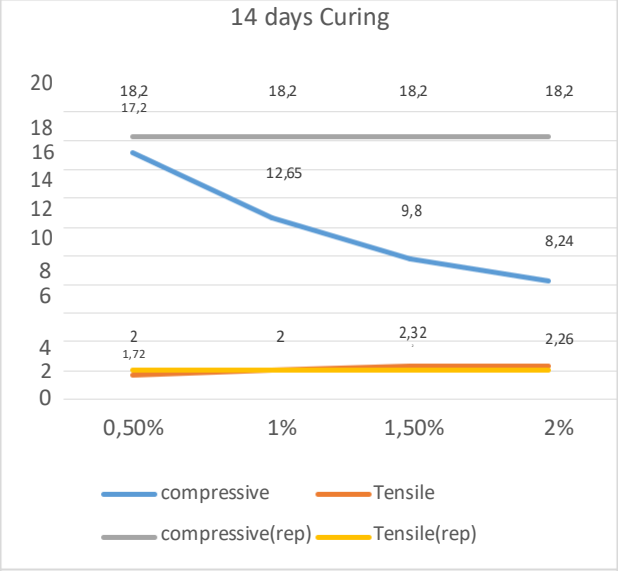
Table 5.2.2 Tensile Strength Test Results (N/mm2)

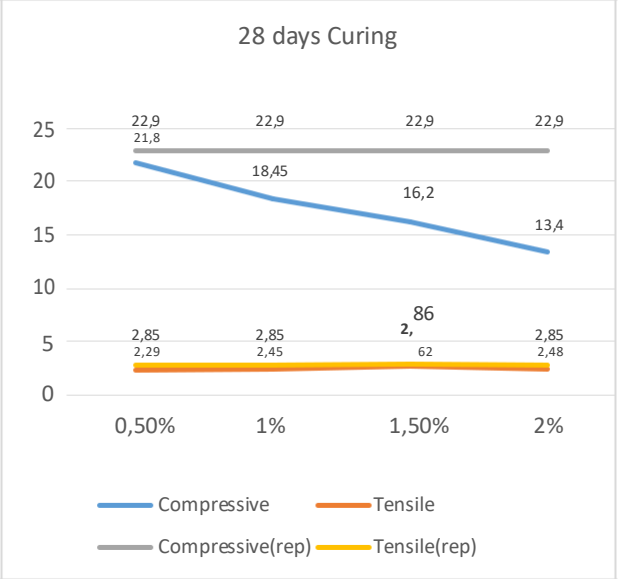
Percentage of Plastic	0.0%	10%
7 days	1.012	1.34
14 days	1.55	2
28 days	2.12	2.85



5.3 ADDITION VS REPLACEMENT OF PLASTIC FIBRE







Conclusion

- The compressive strength reduces while adding the plastic fibre while the tensile strength increases.
- The maximum tensile strength is found when we have added 1.5% plastic fibre by weight of cement.
- If we want to increase the tensile strength without reducing much compressive strength then replacement of fine aggregate by 10% by weight and cured for 28 days is a better option.

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