EXPERIMENTAL INVESTIGATION ON RECYCLED PLASTIC AND COCONUT FIBER IN CONCRETE

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***Abstract*— The main objectives of this research proposal are to evaluate the possibility of using granulated plastic waste materials The following were also proposed. As partial substitute for the fine aggregate (sand) in concrete composites.To investigate the structural behaviour of such replaced concrete components.To investigate the mechanical behaviour of the components by using fibres . To determine the percentage of plastic fibre which gives more strength when compared to control concrete.**

***Keywords*— Recycle Plastic, Coconut Fiber**

I. INTRODUCTION

Waste plastic bottles are major cause of solid waste disposal. Polyethylene Terephthalate (PET, PETE or polyester) is commonly used for carbonated beverage and water bottles. This is an environmental issue as waste plastic bottles are difficult to biodegrade and involves processes either to recycle or reuse.

Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. This project deals with the possibility of using the waste PET bottles as the partial replacement of aggregate in Portland cement. Concrete with 1%, 2%, 4% and 6% PET bottle fibres for fine aggregate were produced and compared against control mix with no replacement.

Cube specimens, cylinder specimens and prism specimens of 18 numbers each were cast, cured and tested for 7 day and 28 days strength. Compression test, splitting tensile test and flexural strength tests were done and the results were compared with control specimens. The findings revealed an increase in compression and tensile strength hence with the increasing demand for fine aggregate, PET bottle fibre replacements can be adopted. The replacement of fine aggregates reduces the quantity of river sand to be used in concrete and also plastic fibres are proved to be more economical.

II. MATERIALS AND METHODS

A. *CEMENT*

The most common cement is used is ordinary Portland cement. Out of the total production. ordinary Portland cement accounts for about 80-90 percent. Many tests were conducted to cement some of them are consistency tests, setting tests, soundness tests, etc.

B. *Fine Aggregate*

Sand used for the experimental program was locally procured and confirmed to Indian Standard Specifications IS: 383-1970. The sand was sieved through BIS 7.75mm sieve to remove any particles greater than 4.75mm and then was washed to remove the dust. Fine aggregate was test as per IS 2386-1963. The fine aggregate belongs to grading zone II. The specific gravity of fine aggregate was 2.6.

C. *Coarse Aggregate*

The maximum size of the coarse aggregate that may be used in cement concrete is 20mm size aggregates-The coarse aggregates with size of 20mm were tested and the specific gravity value of 2.78 and fineness modulus of 7 was found out. 12.5mm size aggregates-.The coarse aggregates size of 12.5mm was tested and the specific gravity value of 3.02 and fineness

modulus of 5.9 was found out. Both types of aggregates were available from local sources and were taken in equal proportions

D. *Recycle Plastic*

Waste is now a glob*a*l problem, and one that must be addressed in order to solve the world's resource and energy challenges. Plastics are made from limited resources such as petroleum, and huge advances are being made in the development of technologies to recycle plastic waste among other resources. Mechanical recycling methods to make plastic products and feedstock recycling methods that use plastic as a raw material in the chemical industry have been widely adopted, and awareness has also grown recently of the importance of Thermal recycling as a means of using plastics as an energy source to conserve petroleum resources. The specific gravity of Recycled plastic was 0.9and Crushing value was 2.

Fig 1: Recycle Plastic

E. *Coconut Fiber*

Coconut fibers obtained from coconut husk, belonging to the family of palm fibers, are agricultural waste products obtained in the processing of coconut oil, and are available in large quantities in the tropical regions of the world; they are available in large quantities in the southern part of the country. The specific gravity of Coconut fiber was 0.9and Crushing value was1.2.

Fig 2: Coconut Fiber

F. *Mix design*:

The mix design of M30 grade concrete is calculated using IS 456-2000 and IS 10262-2009.The material required as per design are given in Table: 1

TABLE: 1

Material required as per the method of design

Materials	W/C ratio	Cement	Fine aggregate	Coarse aggregate
Ratio	0.45	1	1.87	3.37

G.*Curing*

Concrete removed from the mould are protected until they are sufficiently hardened to permit handling without damage. This may take about 24 hours in a shelter away from sun and winds. The concrete thus hardened are cured in a curing yard to Permit complete moisturisation for at least 28 days.

Fig 3: Curing

H.Drying

Concrete shrinks slightly with loss of moisture. It is therefore essential that after curing is over, the blocks should be allowed to dry out gradually in shade so that the initial drying shrinkage of the blocks is completed before they are used in the construction work. Concrete are stacked with their cavities horizontal to facilitate thorough passage of air. Generally a period of 7 to 15 days of drying will bring the concrete to the desired degree of dryness to complete their initial shrinkage. After this the concrete are ready for use in construction work.

Fig 4: Drying

III.EXPERIMENTAL RESULTS

To determine the hardened properties of concrete standard tests like compression test on cubes for compressive strength, split tensile test on cylinders for tensile strength and flexural test on beams for flexural strength of concrete were carried out at 7days and 28days of curing.

A. COMPRESSIVE STRENGTH OF CONCRETE CUBE

The compression test was conducted as per IS 516 – 1959. The specimens were kept in water for curing for 7 days and 28 days and on removal were tested in dry condition and grit present on the surface. The load was applied without shock and increased continuously at a rate of approximately 140 kg/sq cm/min until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained. The maximum load applied to the specimen was then recorded and the appearance of the concrete for any unusual features in the type of failure was noted.

TABLE 2: COMPRESSIVE TEST FOR 28 DAYS CONCRETE CUBES

S.no	Days	Sample	Failure Load
1.	28	0%	844 N
		2%	880 N
2	28	0%	969 N

		4%	990 N
3	28	0%	1020 N
		6%	1052 N

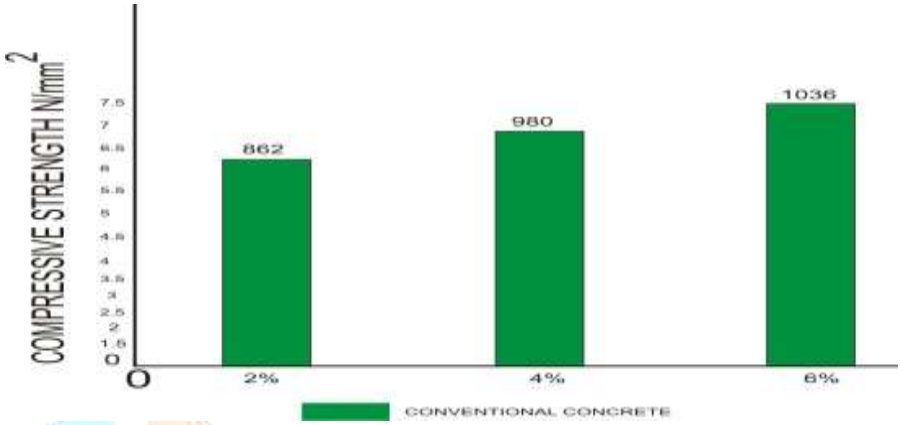

Fig 5: COMPRESSIVE STRENGTH

B. SPILT TENSILE STRENGTH OF CONCRETE

The split tensile test were conducted as per IS 5816:1999. The size of cylinder is 300mm length with 150mm diameter. The specimen were kept in water for curing for 7 days and 28 days and on removal were tested in wet condition by wiping water and grit present on the surface. The test is carried out by placing a cylindrical specimen horizontally between the loading surfaces of a compression testing machine and the load is applied until failure of the cylinder along the vertical diameter. The maximum load applied to the specimen was then recorded and the appearance of the concrete for any unusual features in the type of failure was noted. Average of three values was taken as the representative of batch.

TABLE 3: SPLIT TENSILE STRENGTH 28 DAYS

S.no	Days	Sample	Failure Load
1.	28	0%	580 N
		2%	597 N
2	28	0%	712 N
		4%	730 N
3	28	0%	736 N
		6%	728 N

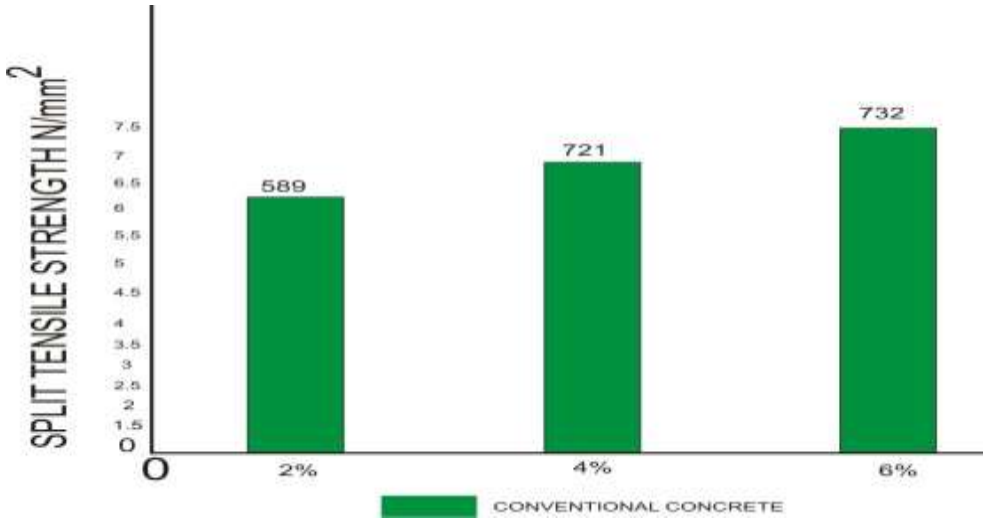

Fig 6: SPLIT TENSILE STRENGTH

C. FLEXURAL STRENGTH FOR RCC BEAM

All beams (100mm x 150mm in cross section and 1600mm in length) were tested as simply supported beams under three point loading over an effective span of 1400mm.The load shall be applied at a rate of loading of 400kg/min for the 15 cm specimens and at a rate of 180kg/min for the 10cm specimens. The loads were applied at a distance of 533mm on either side of the mid span of the beams of 1600mm length. The loads were monitored through a high accuracy load cell with a load sensitive of 0.1 tonnes. For this case, mid span deflection was measured using dial gauges of least count 0.01mm. The parameters such as initial cracking load, ultimate load and the deflected shape of the specimens were noted.

Fig 7: Cracking of the Specimen

TABLE4: FLEXURAL STRENGTH FOR RCC BEAM

S.NO	SPECIMENS	LOAD (kN)	FLEXURAL STRENGTH(N/mm^2)
1	CONTROL BEAM 12mm	73	43.60
		71	41.60
2	Replaced coarse aggregate 2%recycled plastic and 2% coconut fiber	67	37.50
		62	34.60
3	Replaced coarse aggregate 4%recycled plastic and 4% coconut fiber	74	40.04
		77	46.53
4	Replaced coarse aggregate 6%recycled plastic and 6% coconut fiber	82	53.81
		80	49.77

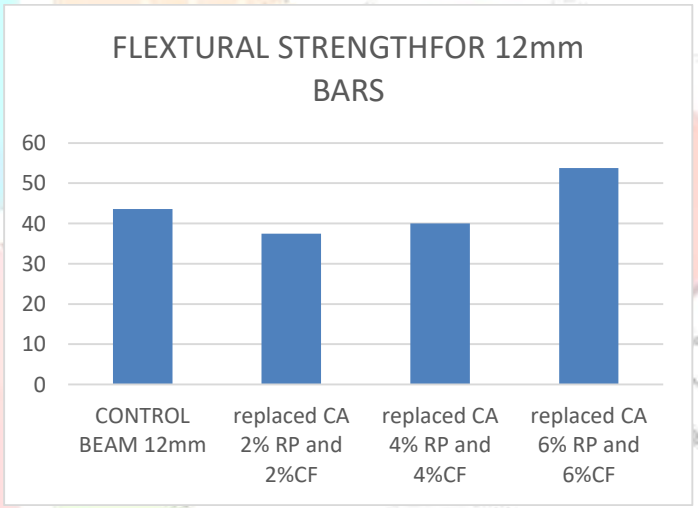

Fig 8: FLEXURAL STRENGTH FOR RCC BEAM

IV. CONCLUSIONS

- The concrete with PET fibers reduced the weight of concrete and thus if mortar with plastic fibers can be made into light weight concrete based on unit weight.
- We conclude that a detailed study was carried out on flexural strength of concrete.
- The compressive strength increases when the replacement of coarse aggregate with 6% PR and 6% CF replaces by the weight of coarse aggregate further replacement of coarse aggregate with PR and CF increase the compressive strength.
- Looking in to above aspect we come to the conclusion that plastic can be in cement concrete mix increase the % in plastic to decrease the strength of concrete.

- By using the plastic and coconut fiber in concrete mix to reduces the weight of specimen up 15%.
- From test results, on replacing with PR and CF (2%, 4%&6%) in comparison with nominal mix and we obtained the optimized strength value 6%.
- Lastly, we strongly conclude the use of Recycled plastic and coconut fiber aggregate in concrete which is the best option for the disposal of plastic & ultimately reduces the pollution in the Environment.

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