PERFORMANCE CHARACTERISTICS STUDY ON HYBRID FIBRE CONCRETE

Bhuvaneshwari P
M.E Construction Engineering and Management: Dept. of Civil Engineering
T.S.M Jain College of Technology,
Kallakurichi, Tamilnadu
bhuvaneshwaripoomalai@gmail.com

Abstract-**The concrete describe for its high strength and durability. But it is well known for its brittle and tensile nature which makes complete loss of loading capacity, once failure is initiate. To overcome this weak spot in concrete, the fibre is added in which it act as a bridge between the cracks and impediment the time of failure and it also reduce the mini cracks. The two fibre combinations increase the properties of concrete compared to single fibre concrete in which one fibre is stronger, stiffer and provides strength, while the other is more supple endow with robustness at high strains. The fibres are dissipate materials which are easily available and cheap may be used for put together of structural units and now there is serious problem with the disposal of dissipate tyre tube, Polyethylene Terephthalate (PET) bottles and other dissipates. The dissipates are hard to biodegrade and involve process moreover to recycle or reuse. The manufacture industry is in requiring of finding cost effective materials for increasing the strength of concrete structures and which is the another way to disposal of dissipate .In the present investigations to study the manipulate of addition of dissipate tyre tube fibre and PET bottle fibre in concrete. The fibres are added as 0.5%, 1%, 1.5% and 2% to weight of the cement in concrete and hybrid combination is studied for various percentages is studied.**

Keywords: Strength, Two fibre, Dissipate tyre tube, Polyethylene Terephthalate .

I. INTRODUCTION

Concrete is a composite consists of aggregate covered in a matrix of cement paste. The performance of concrete depends on its ingredients .It is one of the most broadly used construction material in urbanized and developing countries. The reason behind its recognition is its high strength and durability. But it is well known that, plain concrete is brittle and weak in tension. To overcome this weakness in concrete, fibre is added in addition to its ingredients. The fibre which acts as bridge between the crack and arrest micro cracks which causes gradual failure. Most of the experimental investigation is done with single fibre. The routine of two fibres is checked in this investigation. The addition of two fibres is more proficient than single fibre .The combination of different types of fibres, which differ in material properties, stay bonded together when added in concrete and retain their identities and properties, generally it termed as hybrid fibre concrete. There are wide types of fibre available which are costlier in now days. The fibres from dissipate materials are economical which is used for manufacture of structural units with cement field gun composite have great potential for developing countries like India. The dissipate material like plastic, tyre and other dissipates are causing serious problems with the disposal of dissipate tyre, PET bottles and other dissipates. The dissipate is forsaken as landfill which cause land dilapidation It is difficult to biodegrade and involves processes to recycle or reuse. The construction industry is in requiring of finding cost proficient materials for increasing the strength of concrete structures. The use of treated of rubber tyre tube which increase the bonding between the rubber tube and cement by treating it with 2N of NaOH about 3 hours. The NaOH removes zinc stearate from the rubber surface, which is responsible for the poor adhesive properties. The main objective of the study is to utilize the dissipate material such as tyre tube and Polyethylene Terephthalate (PET) bottle in turn to most select use and to solve the ecological pollution problems.

*A)Tyre Tube fibre:*Tyre tube is made up of rubber material which is the primary material. It is constituent contains metals minerals and hydrocarbons. They made of vulcanized (cross linked polymer chains).

TABLE I COMPOSITION OF RUBBER TUBE [4]

Content	Value (mg/kg)
Calcium	562
Magnesium	106
Zinc	13494
Lead	160
Tin	195

The commonly used tyre rubber is styrene-butadiene co-polymer- SBR containing 25% styrene. The chemical composition of rubber tube is given in Table 1.

1) NaOH analysis of tyre tube fibre

Zinc is the rubber tube fibre, responsible for the lack of adhesion with concrete. The treatment of rubber tube fibre with 2 N of NaOH for 3 hours removes the zinc coating which helps for the superior bonding. It possibly increases the compressive strength.

*B) Polyethylene Terephthalate fibre (PET):*PET is the synthetic fibre. The fibre is feigned from the dissipate pet bottles. The process involves chopping, grinding for the fibre preparation. It is economically less cost compare to other fibre.

II. OBJECTIVES

The utilization of non biodegradable dissipate in concrete which solve the environmental pollution problem. It is the effective way to utilize the dissipate in concrete.

- The main objective is to utilize the dissipate material such as tyre tube and Polyethylene Terephthalate (PET) bottle in turn to optimum use and to solve the environmental pollution problems.
- To resist the sudden brittleness in concrete.
- Analyze the result and to arrive optimum percentage of fibre used in concrete in mono and hybrid combination.

III. LITERATURE REVIEW

P. Ganesh prabhu et al proposed the utilization of dissipate pet bottle fibre in concrete. The PET bottles in fibre form can be used to get better the mechanical properties of concrete. The utilization of the dissipate material reduces the pollution problems and effective material which increase the strength.

K. C. Panda et al studied that Scrap-Tyre-Rubber Replacement for Aggregate in Cement Concrete**.** Investigation on the influence of the rubber content on the mechanical properties of rubberized concrete starting with the 0% rubber content (i.e., without rubber) and up to 12% rubber content in the M20 grade concrete (i.e., with a partial replacement of the coarse aggregate by 3%, 6%, 9% and 12% by volume of the total coarse aggregate). For convenience the researchers took the mix design for M20 grade concrete .For 3 % increase in compressive strength about 32 N/mm^2 for M20 concrete. About 3% it was absorbed that decrease in compressive strength.

F.PachecoTorga et al studied that Tyre rubber dissipates based concrete: a review. Investigations carried out so far reveal that tyre dissipate concrete is specially recommended for concrete structures confirms that the immersion of rubber in NaOH aqueous solution could improve the adhesion leading to a high strength performance of concrete rubber composites. Investigations about rubber dissipate concrete show that concrete performance is very dependent on the dissipate aggregates. Studied the use of different percentage of rubber in concrete (5%, 10%, and 15%) by volume also noticing that as rubber content increase leads to an increase of compressive strength.

IV. EXPERIMENTAL WORK

A)Materials used:

1) Cement

The cement used in the investigation is Ordinary Portland cement of 43 grade which is conforming to the code as per IS 4031-1988.

2)Fine Aggregate

The locally available river sand is used as fine aggregate. The fine aggregate used which have fineness modulus of 2.86, specific gravity of 2.4 and conform to grading zone-II as per IS: 383-1970 specification.

3)Coarse Aggregate

The locally available quarry crushed angular aggregate is used as coarse aggregate of size 20mm.The aggregate used which have specific gravity of 2.8 and fineness modulus of 7.5.

4)PET Fibre

The polyethylene (PET) bottle which is obtained from used drinking water bottles with almost no cost and easily available which is chopped as a fibre. It has the cut length of 3 cm and diameter of 0.02 cm with aspect ratio of 190.

Fig. 1 PET fibre

5)Tyre Tube Fibre

The used tyre tube is easily available and cheap. The tyre tube is cut for various aspect ratios. The tyre tube fibre is treated with 2N of NaOH about 3 hours then washed with water and dried in air.

Fig. 2 Tyre tube fibre

B)Mix Proportion: The concrete mix is designed as per IS 10262-2006 and IS 456-2000.Mix ratio of 1:1.34:2.67 with w/c ratio of 0.45.

*C)Specimen Casting:*Weight batching is made and fibre is added to weight of concrete. For mixing fibre are well distributed to prevent the clustering of fibre. The cube and cylinder is compacted well with tampering rod. Finally cube and is demoulded and allowed for curing for 7 & 28 days.

*D)Test Specimens:*The test specimens of concrete cube size 150mmx150mmx150mm are casted and cured for 7 and 28 days.

TABLE II ASPECT RATIO DETAILS OF TYRE TUBE FIBRE

Mix	Fibre	Length (cm)	Breadth (cm)	%
M1	Tyre	5	0.2	0.5
M2	Tyre	5	0.2	1
M3	Tyre	5	0.2	1.5
M4	Tyre	5	0.3	0.5
M5	Tyre	5	0.3	1
M6	Tyre	5	0.3	1.5

TABLE III PET FIBRE SPECIMENS

Mix	Fibre	%
P1	PET	0.5
P2	PET	1
P3	PET	1.5
P4	PET	2

TABLE IV HYBRID FIBRE COMBINATION SPECIMENS

Mix	Fibre Combination	%
H1	PET+Tyre	0.5+1
H2	PET+Tyre	1+1
H3	PET+Tyre	1.5+1
H4	PET+Tyre	2+1

V. EXPERIMENTAL METHOD

A)Compressive strength test: The compression test is carried in Universal Testing Machine. The cube is tested for 7 and 28 days. The compressive strength test gives the maximum bearable load that concrete can with stand.

B)Split tensile strength test: The tension is conducted in Universal testing machine .The cylinder is tested for 28 days.

VI. RESULT AND DISCUSSION

The compressive strength is measured by firmness testing. The C is control specimen is casted for arrived mix design. The finest for tyre specimen is arrived for the Mix M2 in 1% of fibre with 7% increase in strength. The strength increment is due to treatment of rubber fibre with NaOH create rougher surface makes better bonding. For PET fibre alone, the maximum strength is achieved for P2 with 11% increase in strength compared to the Control

mix .For the hybrid combination H2 mix with higher strength compared to the control mix with 17%. Figure 1 shows optimum average compressive strength of tyre fibre , PET fibre and hybrid fibre combination.

TABLE V AVERAGE COMPRESSIVE STRENGTH OF TYRE TUBE FIBRE

Mix	Average Compressive strength (N/mm^2)	
	7 days	*28 days*
C	22.19	35.23
M1	23.05	36.6
M2	23.8	37.8
M3	22.90	36.35
M4	21.82	35.2
M5	21.51	34.7
M6	21.09	34.02

TABLE VI AVERAGE COMPRESSIVE STRENGTH OF PET FIBRE

Mix	Average Compressive strength (N/mm^2)	
	7 days	*28 days*
P1	23.44	38.2
P2	24.8	39.14
P3	23.25	37.5
P4	22.81	36.8

TABLE VII AVERAGE COMPRESSIVE STRENGTH OF HYBRID FIBRE

Mix	Average Compressive strength (N/mm^2)	
	7 days	*28 days*
H1	24.4	39.21
H2	25.80	41.32
H3	23.81	38.2
H4	23.12	36.13

TABLE VIII COMPARISON OF AVERAGE COMPRESSIVE STRENGTH

Concrete composition	Fibre	Average compressive strength (N/mm^2)
Conventional concrete	-	35.23
Tyre fibre concrete	TYRE	37.8
PET fibre concrete	PET	39.14
Hybrid fibre concrete	PET+Tyre	41.32

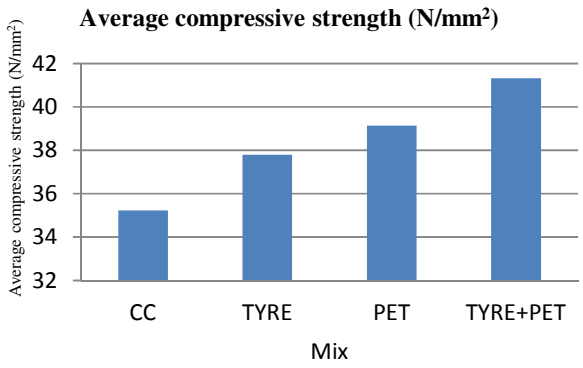

Fig.3 Comparison of Average Compressive Strength

The split tensile strength is increased about 33% compared to the conventional mix. The treatment of fibre shows the improvement of tensile strength.

TABLE VIII COMPARISON OF AVERAGE SPLIT TENSILE STRENGTH

Concrete Composition	Fibre	Split Tensile Strength

		(N/mm^2)
Conventional concrete	-	3.18
Tyre fibre concrete	TYRE	3.52
PET fibre concrete	PET	3.86
Hybrid fibre concrete	PET+Tyre	4.24

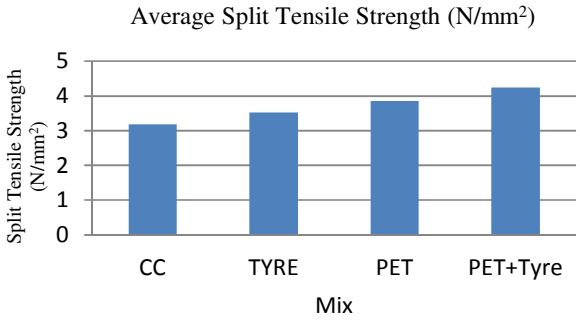

Fig.4 Comparison of Average split tensile Strength

VII. CONCLUSION

The experimental investigation conclusion from the compressive strength is described here

- The tyre fibre is new fibre which can improve the compressive strength compared to the conventional concrete up to 7 %.
- The hybrid combination of tyre and PET fibre shows better improvement of result 17% increase in compressive strength compared with conventional concrete, 8.5% and 5.5% increase in compressive strength compared with tyre tube fibre concrete and PET concrete.
- For observing the better performance of hybrid combination is tested for tensile and flexural strength.

VIII REFERENCES

[1]P.Ganesh Prabhu, C.Arun Kumar, R.Pandiyaraj, P.Rajesh and L.Sasi Kumar, "Study on Utilization of Dissipate pet Bottle Fiber in Concrete", *International Journal of Research in Engineering & Technology*, Vol. 2, Issue 5, pp. 233-240,2014.

[2]M.S.H.Mohd Sani and F.Muftah, "Assessment on Compressive Strength of Dissipate Rubber Tube Tyre (WRTT) Fiber in Concrete", *IEEE Symposium on Business, Engineering and Industrial Applications*, pp.365-367,2012.

[3]K.C.Panda, P.S.Parhi and T.Jena, "Scrap-Tyre-Rubber Replacement for Aggregate in Cement Concrete: Experimental Study", *International Journal for Earth Sciences and Engineering*, Vol. 05, No. 06 (01), pp.1692-1701,2012.

[4]M.R.Wakchaure, Prashant A. Chavan, "Dissipate Tyre Crumb Rubber Particle as A Partial Replacement to Fine Aggregate in Concrete", *International Journal of Engineering Research & Technology (IJERT)*, Vol. 3, Issue 6, June – 2014.

[5]G.Murali, C.M.Vivek Vardhan, R.Prabu, Z.Mohammed Sadaquath Ali Khan, T.Aarif Mohamed and T.Suresh, "Experimental investigation on Fibre reinforced concrete using dissipate materials", *International Journal of Engineering Research and Applications*, Vol. 2, Issue 2, pp.278-283,2012.

[6]IS 10262:2009, "Concrete Mix Proportioning – Guidelines First Revision", July, 2009.