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A Study on Normal Compacting Concrete by Using Rubber Fibers

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***Abstract*-- This paper study the feasibility of using waste tyres in the form of rubber fibers with different sizes in concrete to improve the mechanical properties of the concrete as well as protecting the environment on this earth from the pollutants. Also it reviews the potential application in the field by exploiting its unique characteristics and properties. In this paper, the use of rubberized concrete in structural members its suitability for the concrete, its uses, barriers and benefits are studied. The present investigation includes casting and testing of cubes, cylinders and prisms of different grades of concrete and rubber fibers at a particular aspect ratio is added as 5% and 10% by volume of concrete. The specimens are tested for compressive, split tensile and flexural strength. The test results are indicating that, due to addition of rubber fibers strength of concrete is falling, but as observing ductility is improving. Hence, it is useful for medium grades of concrete. Rubber fiber concrete has light weight, resistance from water absorption and improves ductility and tried to protect our environment on this from pollutants.**

***Keywords*-- aggregate, grade of concrete, rubber fiber strength and workability**

I. INTRODUCTION

Throughout the world, the disposal of used tyres is a major environmental problem causing environmental hazards such as bleeding ground for mosquitoes, producing uncontrolled fire and they are pollute and contaminating the soil and vegetation. Therefore, there is an urgent need to identify alternative outlets for these tyres, with the emphasis on using the waste tyre. Concrete being very weak in toughness, there arise a need to improve its ducility by using certain substitute materials. Fiber reinforced concrete is a rapidly developing field in Civil economic Engineering practices. Use of tyre rubber fibers is a new technique used in the form of fiber reinforced concrete. Concrete is an excellent structural material and considered as essential for the modern civilization and human society. Now, the use of waste tyres in concrete has become technically feasible and the concrete is being considered as light weight concrete.

II. LITERATURE REVIEW

M. Mavroulidou and J.Figueiredo (2010) studied on "discarded tyre rubber as concrete aggregate: a possible outlet for used tyre" they concluded that despite a great loss in strength, rubberized concrete was acceptable for various applications requiring medium to low compressive strength. The quantities of concrete produced worldwide for such applications could ensure the viability of product. Rubberized concrete shows promise for becoming an additional sustainable solution for tyre rubber waste management.

III. MATERIAL PROPERTIES

Cement: Ordinary Portland Cement (OPC) of 53 Grade from a single lot was used throughout the course of the investigation. It was fresh and without any lumps. The specific gravity of cement obtained is 3.13.

Fine Aggregate: The fine aggregate used is natural sand obtained from the river Godavari conforming to grading zone-II. The specific gravity and fineness modulus are 2.61 and 3.64 respectively.

Coarse Aggregate: Crushed granite angular aggregate of size 20mm are used and the aggregates are free from dust before used in the concrete. The specific gravity and fineness modulus are 2.80 and 5.57 respectively.

Water: This is the least expensive but most important ingredient of concrete. A good thumb rule to follow is that if water is pure enough for drinking it is suitable for mixing concrete. Locally available portable water was used for mixing and curing.

Rubber Fiber: Rubber fibers are used of varying length with an aspect ratio of 10, the rubber fibers are incorporated in the concrete as 0%, 5%, and 10% by volume of the concrete. The specific gravity of rubber fibers is 1.01 calculated with pycnometer. The figure: 1 shows heap of Rubber fibers after passing through 2.36mm and retained by 1.18mm IS sieves.

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Fig.1 Rubber fibers

IV. Mix Proportion And Experimental Work

The experimental work consists of casting, curing and testing of cubes and cylinders and Prisms among which are plain and rubberized concrete tested under axial compression, the different grades of concrete are M20, M30 and M40 with different amount of rubber fibers. The amount of rubber fibers of 0%, 5% and 10% added to concrete for the preparation of cubes, cylinders and prisms are tested for compressive strength for cubes split tensile strength for cylinders and flexural strength for prisms after curing. Details of mix proportion and hardened properties are shown in table:1 and table:2.

Table:1
Details of mix proportion

S.No	Mix Id.	Volume of fiber (%)	Cement (kg/m³)	W/C-ratio	Water (liters)	F. A (kg/m³)	C.A (kg/m³)
1.	M20	0.0,5&10	379.59	0.49	186	579.42	1262.03
2.	M30	0.0,5&10	416.52	0.46	191.6	564.43	1229.39
3.	M40	0.0,5&10	456.0	0.43	196.08	560.04	1188.34

Table:2
Compressive, split tensile and flexural strength (MPa)

Concrete Grade	% of rubber fiber	Compressive strength(MPa)			Split tensile strength(MPa)			Flexural strength(MPa)		
		7d	28d	90d	7d	28d	90d	7d	28d	90d
M20	0	19.50	28.0	31.30	2.19	3.16	3.47	3.47	5.04	5.55
	5	16.83	23.25	25.69	1.88	2.58	2.87	3.09	4.13	4.57
	10	13.74	19.80	22.86	1.57	2.24	2.56	2.47	3.57	4.19
M30	0	29.97	39.03	43.74	3.38	4.36	4.88	5.38	6.97	7.85
	5	23.08	29.40	32.81	2.59	3.29	3.67	4.15	5.26	5.88
	10	16.38	23.90	25.62	1.86	2.65	2.89	2.94	4.29	4.59
M40	0	39.81	49.6	52.14	4.45	5.55	5.79	7.15	8.84	9.34
	5	28.20	34.90	36.12	3.16	3.88	4.16	5.07	6.26	6.49
	10	19.75	27.30	29.32	2.19	3.23	3.28	3.56	4.89	5.31

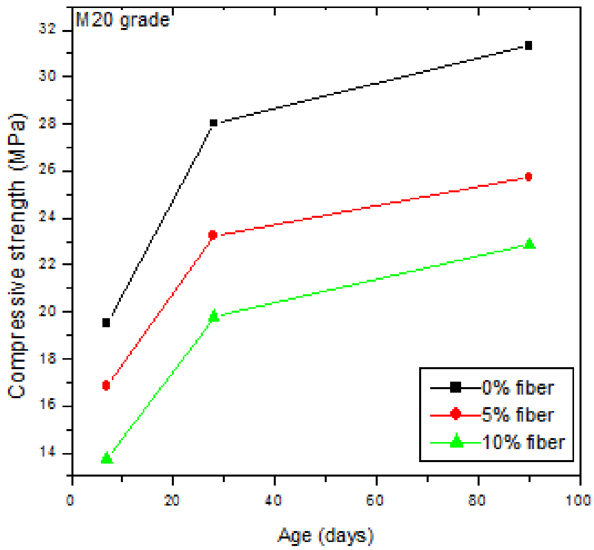

Fig.2 Compressive strength Vs. age

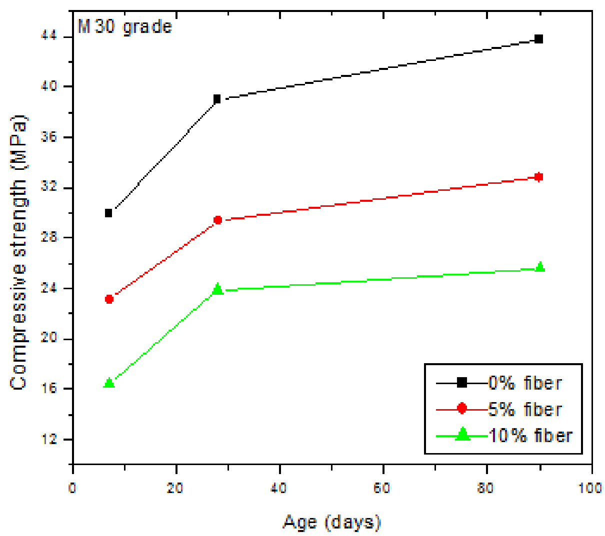

Fig.3 Compressive strength Vs. age

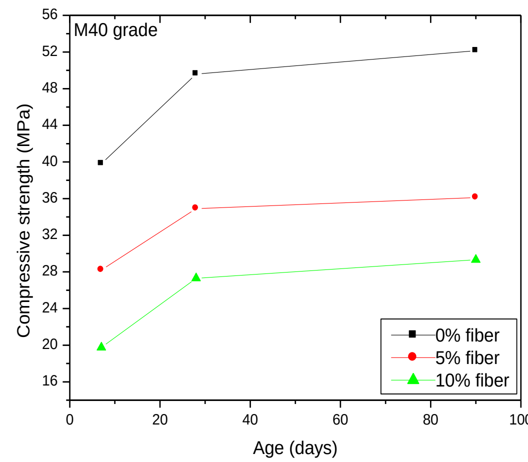

Fig.4 Compressive strength Vs. age

The above Fig.2 to 4 shows the compressive strength Vs. age for M20, M30 and M40 Grades on the incorporation of 5% and 10% of rubber fibers for 7, 28 and 90days. For M20 grade the strength reduced by 13.69% and 29.54% for 7days, 16.96% and 29.28% for 28 days, 17.92% and 26.96% for 90 days. It is observed that for M30 grade the strength reduced by 22.99 % and 45.34 % for 7 days, 24.67% and 38.76% for 28 days, 24.99% and 41.43% for 90 days. Similarly for M40 grade the strength reduced by 29.16% and 50.39% for 7 days, 29.64% and 44.96% for 28 days, 30.72% and 43.77% for 90 days over the normal concrete**.**

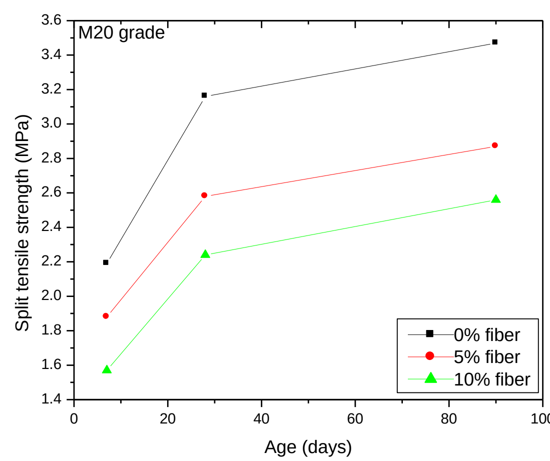

Fig.5 Split tensile strength Vs. age

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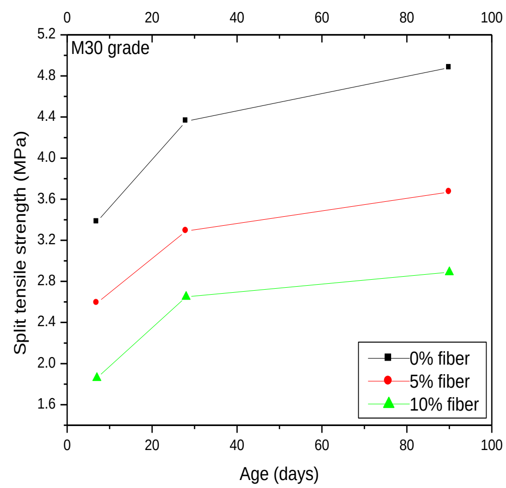

Fig.6 Split tensile strength Vs. age

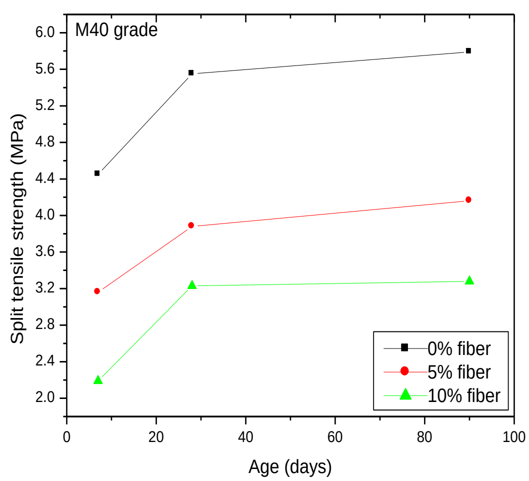

Fig.7 Split tensile strength Vs. age

The above Fig.5 to7 shows the split tensile strength Vs. age for M20, M30 and M40 grade on the incorporation of 5% and 10% of rubber fibers. For M20 grade the strength reduced by 14.15% and 28.31% for 7 days, 18.35% and 29.11% for 28 days, 17.29% and 26.22% for 90 days. For M30 grade the strength reduced by 23.37% and 44.97% for 7 days, 24.54% and 39.22% for 28 days, 24.79% and 40.78% for 90 days.

Similarly for M40 grade the strength reduced by 28.99% and 50.79% for 7 days, 30.09% and 41.80% for 28 days, 28.15% and 43.35% for 90 days over the normal concrete.

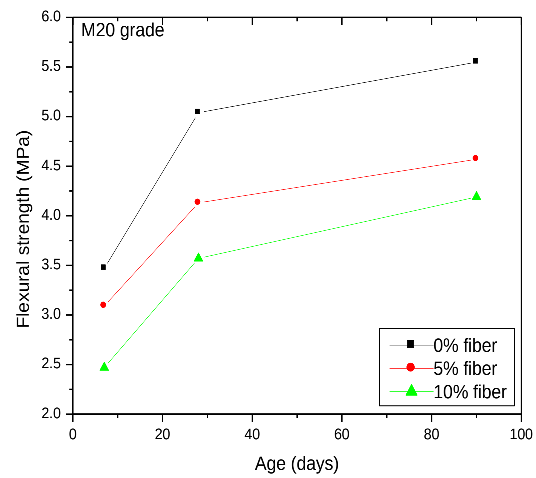

Fig.8 Flexural strength Vs. age

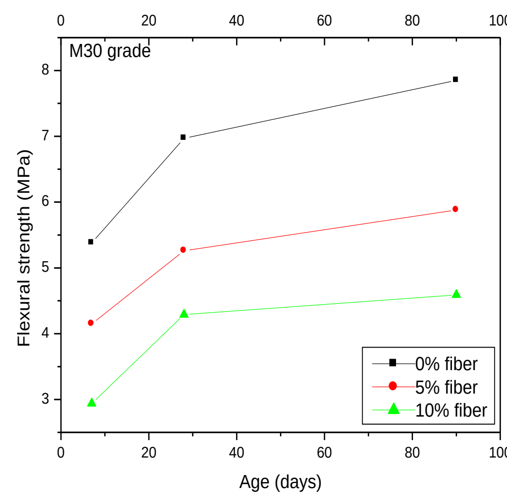

Fig.9 Flexural strength Vs. age

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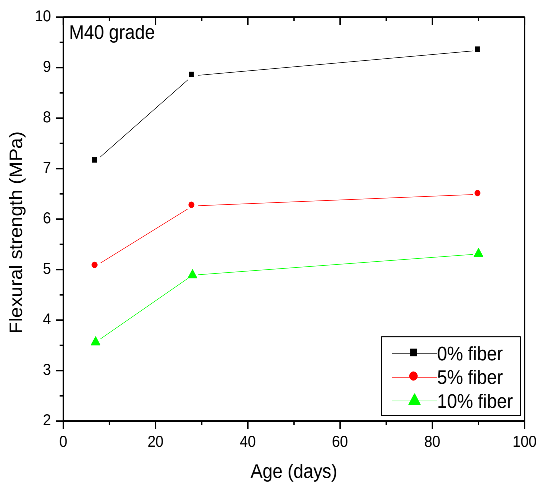

Fig.10 Flexural strength Vs. age

As shown above Fig.8 to 10 are flexural strength Vs. % age for M20, M30 and M40 grade on incorporation of 5% and 10% rubber fibers. For M20 grade the strength reduced by 10.95% and 28.82% for 7 days, 18.05% and 29.17% 28 days, 17.66% and 24.50% for 90 days. For M30 grade the strength reduced by 22.86% and 45.35% for 7 days, 24.53% and 38.45% for 28 days, 25.09% and 41.53% for 90 days. Similarly for M40 grade the strength reduced by 29.09% and 50.21% for 7 days, 29.18% and 44.68% for 28 days, 30.51% and 43.15% for 90 days over the normal concrete.

V. CONCLUSIONS

The following conclusions are drawn from the experiment al study

- Ease of preparation and finishing was also assessed. It was found that rubber fiber concrete mixes did not pose any difficulties in term of finishing, casting, or placement, and that a good quality finish can be achieved although additional effort is required to smooth the finish surface.
- The test results show that the use of rubber fiber in normal concrete mixes produces a significant reduction in concrete compressive strength which increases with increasing rubber fiber content.
- The various rubberised concrete mixes were designed in accordance with standard mix design procedures for normal concrete with a grade of M20, M30 and M40. As expected, the target strengths were not achieved for the mixes incorporating rubber fiber. However, concrete mix design is approximate and any concrete batch must be tested to ensure that the specified mechanical properties are achieved.
- The rubber fiber is very less cost with compare to aggregate and it will be found at various retreading and tyres manufacturing companies, we use disposed waste rubber for the casting of cubes, cylinders and prisms in the laboratory. Advantage in this paper is economical but strength is less than permissible of normal concrete and it is useful for the medium grades of concrete.
- Fiber reinforced concrete is light weight, resistance from water absorption, improves ductility, economical and mainly eco- friendly.

REFERENCES

[1] Serge, N. and I. Joekes, 2000. "Use of Tyre Rubber Particles As Addition To Cement Paste". Cement Concrete Journal, Res., 1421-1425.

[2] N. Oikonomou, and S. Mavridou.6 July 2009 "Improvement of Chloride Penetration Resistance In Cement Mortars Modified With Rubber From Worn Automobiles Tyres"., Cement and Concrete Composites, Vol. 31,pp. 403-407.

[3] J. Kang and Y. Jiang.4 2008.,"Improvement of Cracking –Resistance and Flexural Behaviour of Cement based Materials by Addition of Rubber Particles", Journal of Wuhan University of Technology – Material Science Edition, Vol.23, pp. 579-583.

[4] Hemandez-Oliveres, F. and Barluenga, G., "Fire Performance of recycled rubber – filled high strength concrete" Cement and Concrete Research, Vol 34, No. 1-3,(2003) pp 109-117.

[5] Y. Li, 2009 " Influence of Superplasticizer and Redispersible Polymer Powder on the Strength of Crumb Rubber Mortar", Journal of Beijing University of Technology, Vol.35,pp.1215- 1219.

[6] Guoqiang Li, Michael, A. Stibblefield, Gregory Garrick, John Eggers, Christopher Abadic and Baoshan Huang, 2004. "Development of Waste Tyre Modified Concrete", Journal Cement Concrete .,Res., 2283-2289.

[7] A. Mohd Mustafa Al Bakri, S. A. Syed Nuzul Fadli, M. D. bu Bakar and K. W Leong "comparison of rubber as aggregate and Rubber as filler in concrete" 1st International Conference On Sustainable Materials 2007_ICoMS 2007, 9-11 June 2007, Penang.

[8] M. MAVROULIDOU AND J. FIGUEIREDO "discarded tyre rubber as concrete aggregate: a possible outlet for used tyre" Global NEST Journal, Vol 12, No 4, pp 359-367, 2010.

[9] Kamil E. Kaloush, P.E. George, B. Way, P.E Hanzhu, 2005. "Properties Of Crumb Rubber Concrete", submitted for presentation and publication at the 2005 Annual Meeting of the Arizona State Transportation Research Board, by Arizona State University in November 15, 2004, and published in Journal of the Transportation Research Board under the Category Materials and Construction, D0I10.3141/1914-02,pp8-14.

[10] Gregory GRRICCK, 2004 "Analysis of Waste TyreModified Concrete", In: 2004 ME Graduate student Conference, Louisiana state University.

[11] Hernandez- Olivares, F., G. Barluenga, M. Bollati and B. Witoszek, 2002., "Static And Dynamic Behaviour Of Recycled Tyre Rubber Filled Concrete" Cement Concrete pp1587-1596.