An Experimental Investigation Of Reinforced Cement Concrete By Using Superfluous Rubber Incorporated With Recron Fiber

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ABSTRACT

Now a days waste tyre is create a nuisance to society An effective and efficient way to use it i.e. by means of using it in construction material. Superfluous rubber is used due to its light weight and being a elastic material and simultaneously Recron fiber for its ductile and flexural Properties. In this research work, there are two dissimilar mixes. M25 mix in which Superfluous rubber was replaced at dissimilar replacement levels (0%, 10%, 20%, 30% and 40%) and same replacement for M30 mix keeping 2% Recron fiber constant in above mix. Mechanical and durability properties were studied. When we contrast the strength of above two mixes M30 mix concrete containing 2% Recron fiber shows good results as its compressive and flexural strength increases compared to M25 mix. When the replacement of 10% is done there is nearly 33%, and 20% rise in compressive and flexural strength of rubber concrete with 2% Recron fiber.

Keywords: *Conventional concrete, Superfluous rubber tyre, Recron fiber, Mechanical properties.*

1. INTRODUCTION

The country where every budget proposal involves large construction of bridges, roads, residential and educational buildings etc. These construction schemes demand efficient and optimum use of construction resources. Most of the modern heavy constructions require cement and natural resources such as river sand and rock strata. Cost of both the materials rapidly increasing because of rise of transport cost and inadequate raw materials. In this essence the waste tyre rubber can be used as an effective replacement for natural aggregate.

Disposal of waste tyre rubber has grown to be a major environmental difficulty in all parts of world very serious risk to ecology. The waste tyre is a promising product in construction industry due to its light weight, elasticity, power absorption, sound and heat insulating assets. One of the viable solutions for the use of scrap tyre rubber is to substitute some of the natural aggregate by waste tyre rubber. The rubberized concrete is durable, much less ductile and has greater crack resistance. The abrasion resistance and water absorption (up to 10% substitution) showed good results than that of control mix. Tyre shreds can be useful as back fill for walls and bridge abutments. It can be used to build embankments on weak, compressible foundation soils. Extra water is unconfined when sub grade soils in the spring. putting a 15 to 30cm thick shredded layer underneath the road curb prevents sub grade soils from freezing. Scrap tyres may be used in land fill capping and closures, and as a material for daily cover.
These were utilized to reinforced brittle material before cement was known since Babylonian and Egyptian civilizations. The main object of fibers is to bridge the cracks that develop in concrete and to expand the ductility of concrete elements. Fibers improvise the pressure at peak load and grant extra additional energy absorption potential of reinforced concrete structures. It was recently researched that they notably improve static flexural strength of concrete as properly as its impact strength, tensile strength, ductility and flexural toughness. Fiber reinforcement is normally randomly distributed throughout the entyre element. Besides that, the character of fiber reinforced concrete varies with type of concrete, geometrics, fiber materials, distribution, orientation and volume fraction. They also minimize the permeability of concrete and hence reduce bleeding of water. Fiber reinforced concrete is a concrete containing fibrous material which induces its structural integrity. In recent days fibers are used as a crack arrester and it improves mechanical properties and toughness.

2. EXPERIMENTAL PROGRAMME

Materials Used

The cement used was ordinary Portland cement of 53 grade. The tests carried out are specific gravity 3.15, normal consistency 32, initial and final setting time are 48 and 255 minutes as per IS: 2269-2013.

Rubber tyre

Rubber tyre obtained from the tyre shop. Tyre used in this experiment was obtained from Bhopal, Madhya Pradesh, India.

Table.1 Properties of Rubber tyre

SI No.	Characteristics	Test results
1	Appearance	small pieces (square, diamond)
2	Color	Black
3	Size	4.75-20mm
4	Water absorption	3.8%
5	Bulk density	490 kg/m3

Recron fiber

In this project hooked end fibers are used. The physical properties of this fiber are listed below.

Table.2 Physical properties of Recron fiber

SI No.	Characteristics	Test results
1	Recron fiber type	Double hooked end
2	Diameter(mm)	0.7
3	Length(mm)	60

Mix Proportion

The Mix Design of concrete as per IS: 10262-2009 has to be done to know the proportions of concrete. The water-cement ratio for M25 is 0.42. Total six dissimilar mixtures of concrete were prepared in the laboratory. First is the conventional concrete without any additives. Next with the concrete containing rubber tyre in the varying percentages of 0, 10, 20, 30 and 40% replacing coarse aggregates and next water cement ratio of M25 is 0.40 were casted where 2% Recron fiber is included in the above replacement. The details of mix proportion of all the concrete are in table 2.

Table.3 Mix Proportions of concrete for M25

Notation	Constituents (kg/m3)				
	Cement	**Fine Aggregate**	**Coarse Aggregate**	**Water**	**Rubber tyre**
T0(0% rubber tyre)	437	675	1106	197	0
T10(10% rubber tyre)	437	675	995.4	197	88.60
T20(20% rubber tyre)	437	675	884.8	197	199.12
T30(30% rubber tyre)	437	675	774.2	197	309.90
T40(40% rubber tyre)	437	675	663.6	197	420.55

Table.4 Mix Proportions of concrete for M30

Notation	Constituents (kg/m3)					
	Cement	Fine aggregate	Coarse Aggregate	Water	Rubber tyre	Recron fiber
T0(0% rubber tyre)	456	603	1068	238.5	0	0
TS10(8% rubber with 2% Recron fiber)	456	603	1068	238.5	88.48	21
TS20(18% rubber with 2% Recron fiber)	456	603	1068	238.5	199.08	21
TS30(28% rubber with 2% Recron fiber)	456	603	1068	238.5	309.68	21
TS40(38% rubber with 2% Recron fiber)	456	603	1068	238.5	420.28	21

3. RESULTS AND DISCUSSION

3.1 Workability of Concrete

3.1.1 Slump Cone Test

The slump test is carried out for all the dissimilar concrete mixtures to know the workability of concrete. The slump test values for dissimilar concrete mixture are in table 3.The slump value for control concrete will be slightly higher compared to other mixtures and the degree of workability will be high. The incorporation of both rubber concrete decreases the slump value. As the rubber quantity of rubber Increases the slump value decreases this reduction in slump values.

Table.5Results of Slump Test containing rubber tyre

Concrete type	Slump (mm)	Degree of workability
T0	96	Medium
T10	86	Medium
T20	77	Low
T30	66	Low
T40	58	Low

Table.6 Results of Slump Test containing rubber tyre and 2%Recron Fibre

Concrete type	Slump (mm)	Degree of workability
TS0	108	High
TS10	98	Medium
TS20	88	Medium
TS30	76	Low
TS40	68	Low

Compressive Strength Test

In this Research work, 3 cubes from each mix proportion were tested and average is taken as compressive strength of concrete. There will be a decrease in strength of concrete at 10% replacement of rubber, then compressive strength goes on decreasing gradually as the amount of rubber increases. When 2% Recron fiber used the compressive strength of concrete goes on increasing.

Table 7 Compressive Strength test results of rubber concrete

Concrete type	Num of specimens	Compressive strength (Mpa)	
		7 days	28 days
T0(normal concrete)	3	28.20	32.60
T10	3	25.23	26.50
T20	3	26.20	27.51
T30	3	18.30	21.23
T40	3	15.60	18.50

Table 8 Compressive Strength test results of rubber concrete with 2% Recron fiber

Concrete type	No. of specimens	Compressive strength (Mpa)	
		7 days	28 days
TS0(normal concrete)	3	29.05	35.02
TS10	3	26.41	27.90
TS20	3	28.20	28.25
TS30	3	19.70	22.50
TS40	3	17.82	19.10

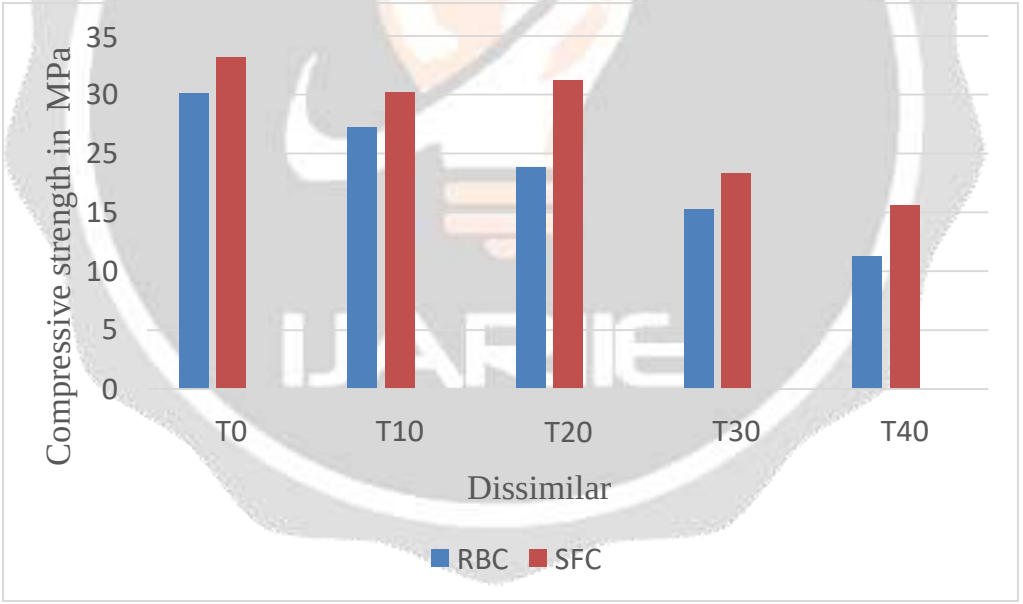

Figure.1 Graph indicating the compressive strength for 7 days

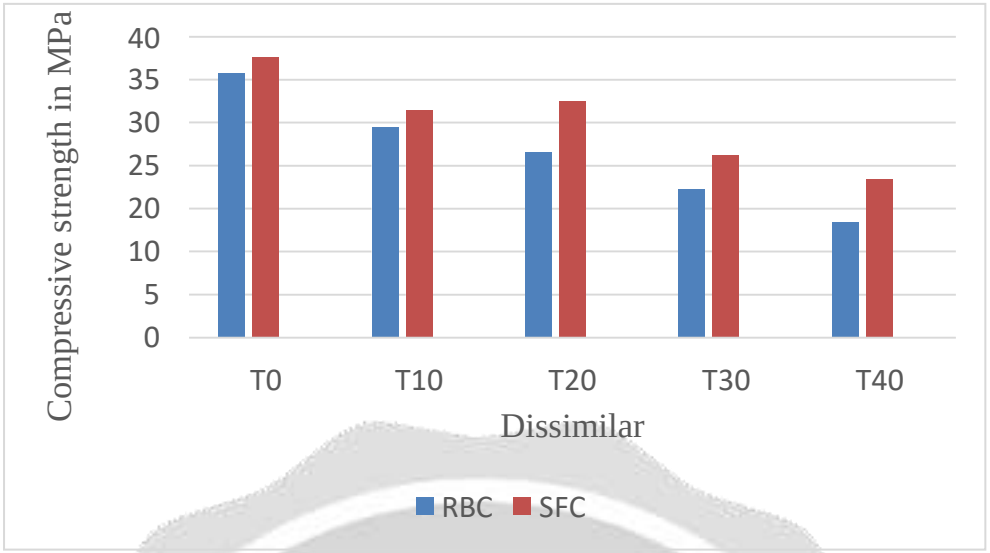

Figure.2 Graph indicating the compressive strength for 28 days

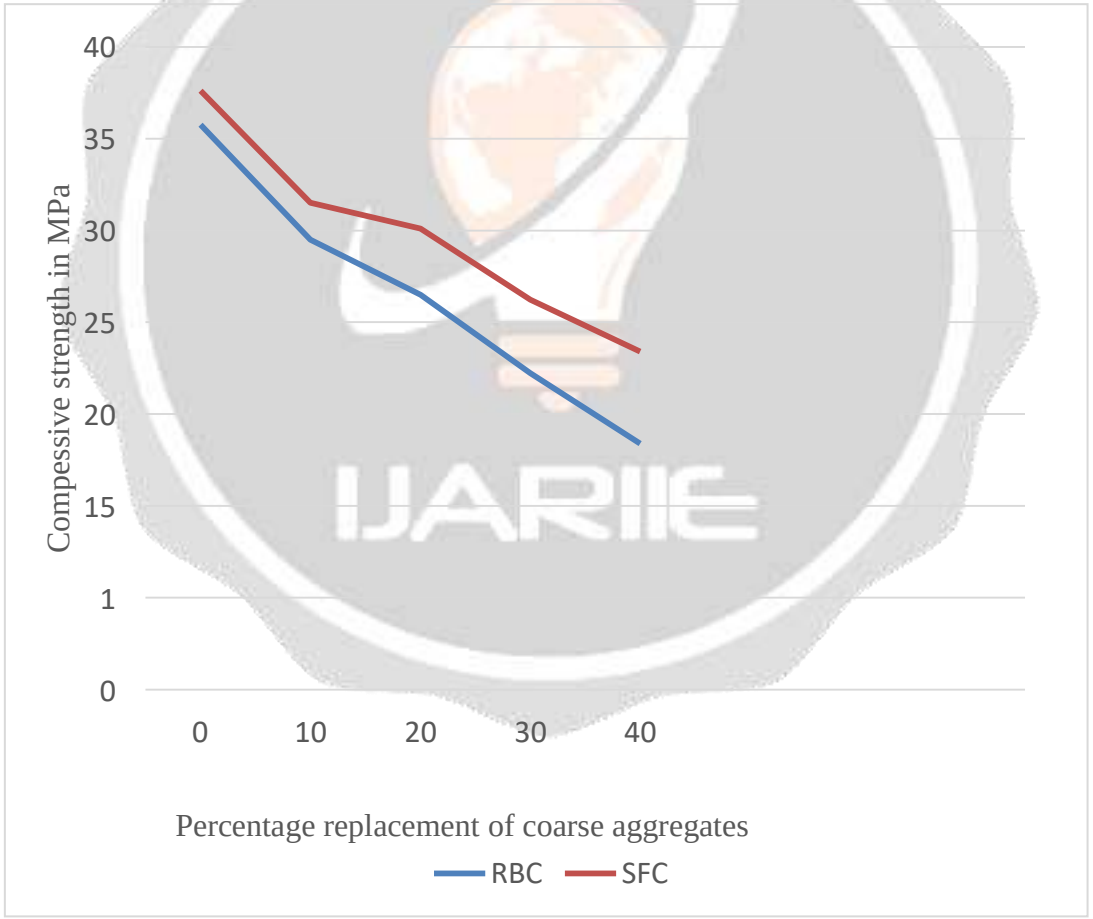

Figure.3 Increase in compressive strength of rubber concrete with 2% Recron fiber (SFC) compared to rubber concrete (RBC) for 7 days

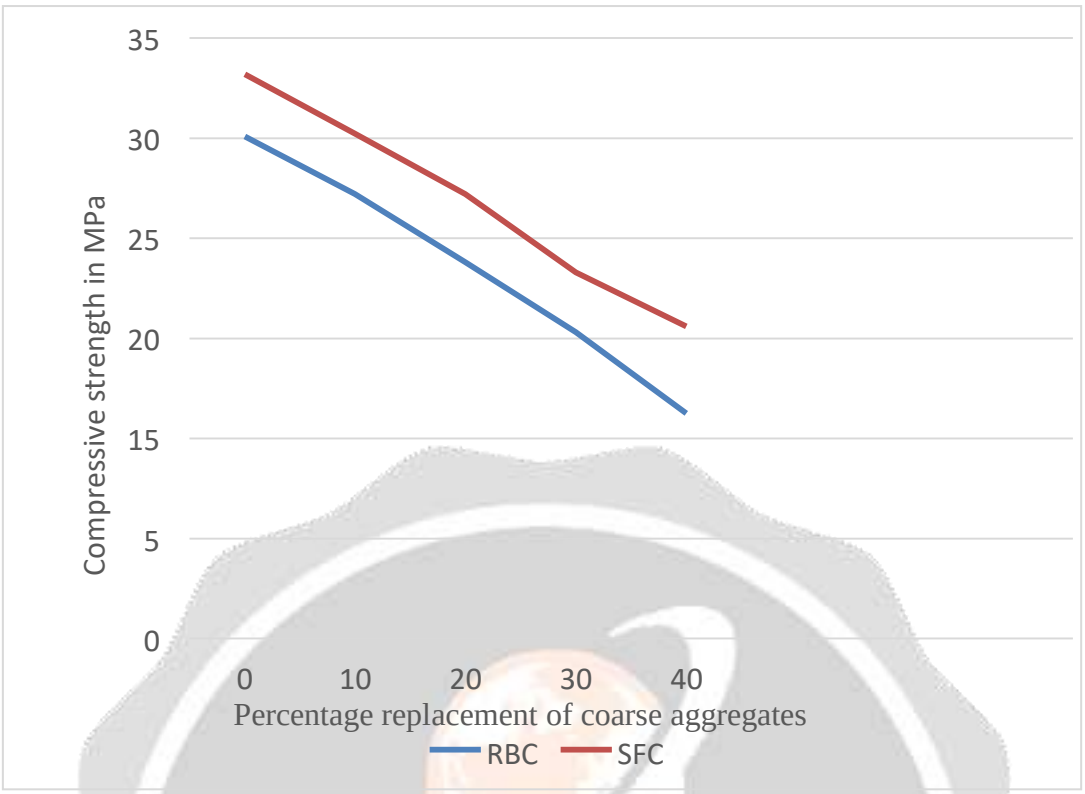

Figure.4 Increase in compressive strength of rubber concrete with 2% Recron fiber (SFC) compared to rubber concrete (RBC) for 28 days

Flexural Strength Test

The strength of the specimen is calculated by using two-point loading method with the help of a hydraulic testing machine.

Table 9 Flexural Strength test results of rubber concrete

Concrete type	Num of specimens	Flexural strength (Mpa)	
		7 days	28 days
T0(normal concrete)	3	3.02	3.60
T10	3	2.70	3.20
T20	3	2.50	2.76
T30	3	2.10	2.34
T40	3	1.80	2.06

Table 10 Flexural Strength test results of rubber concrete with 2% Recron fiber

Concrete type	Num of specimens	Flexural strength (Mpa)	
		7 days	28 days
TS0(normal concrete)	3	3.32	4.01
TS10	3	2.95	3.50
TS20	3	2.81	3.00
TS30	3	2.23	2.52
TS40	3	1.90	2.12

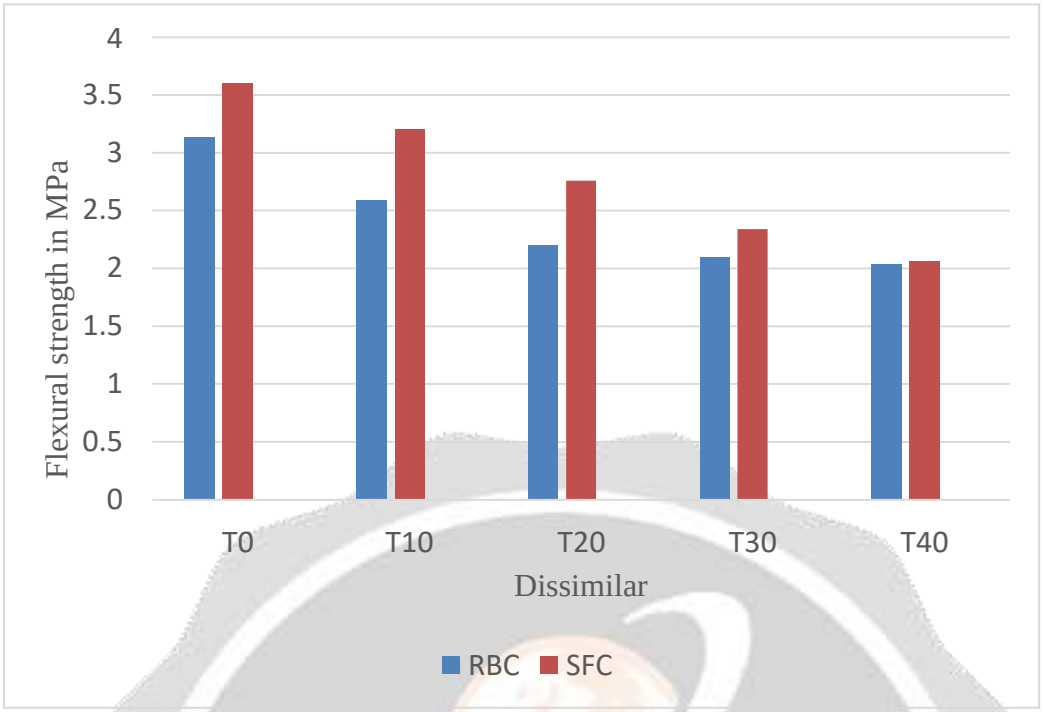

Figure. 5 Graph showing flexural strength for 28 days

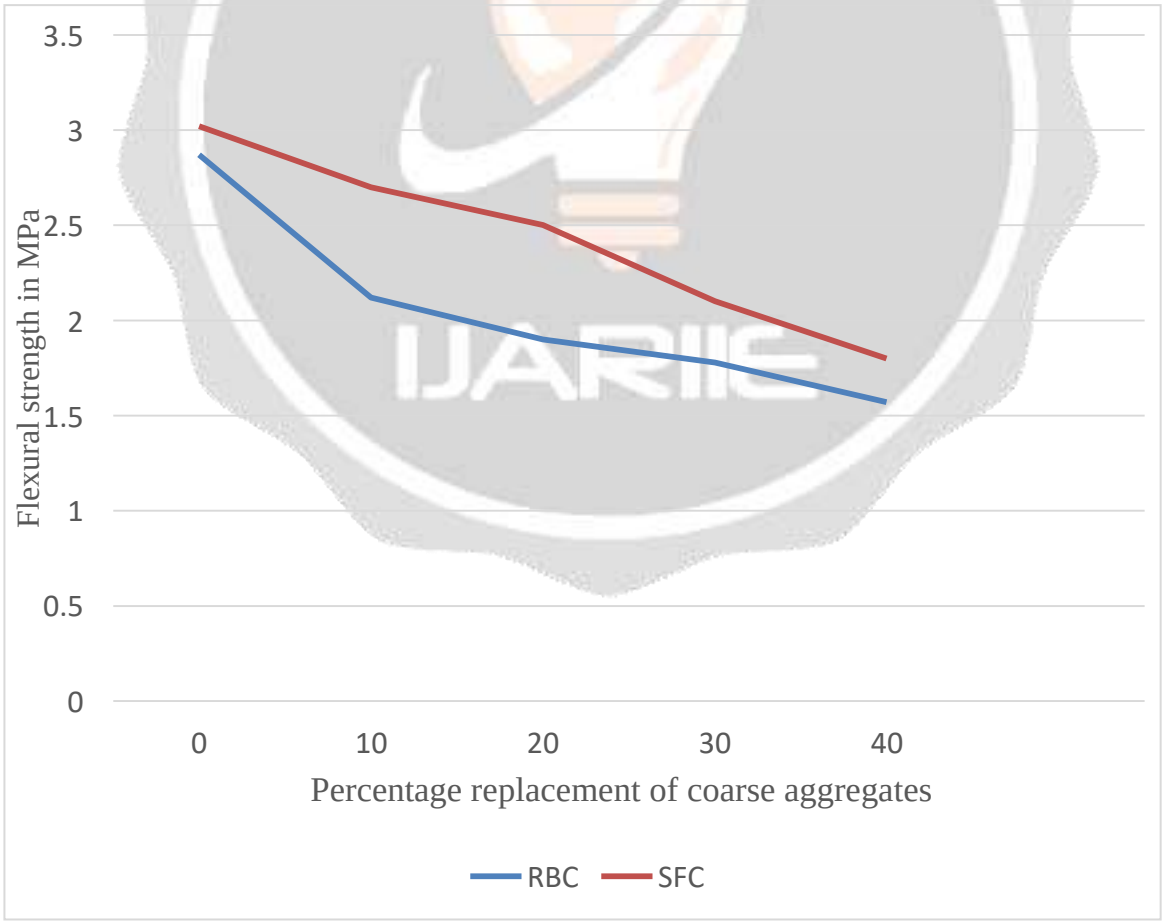

Figure. 6 Graph showing flexural strength for 28 days

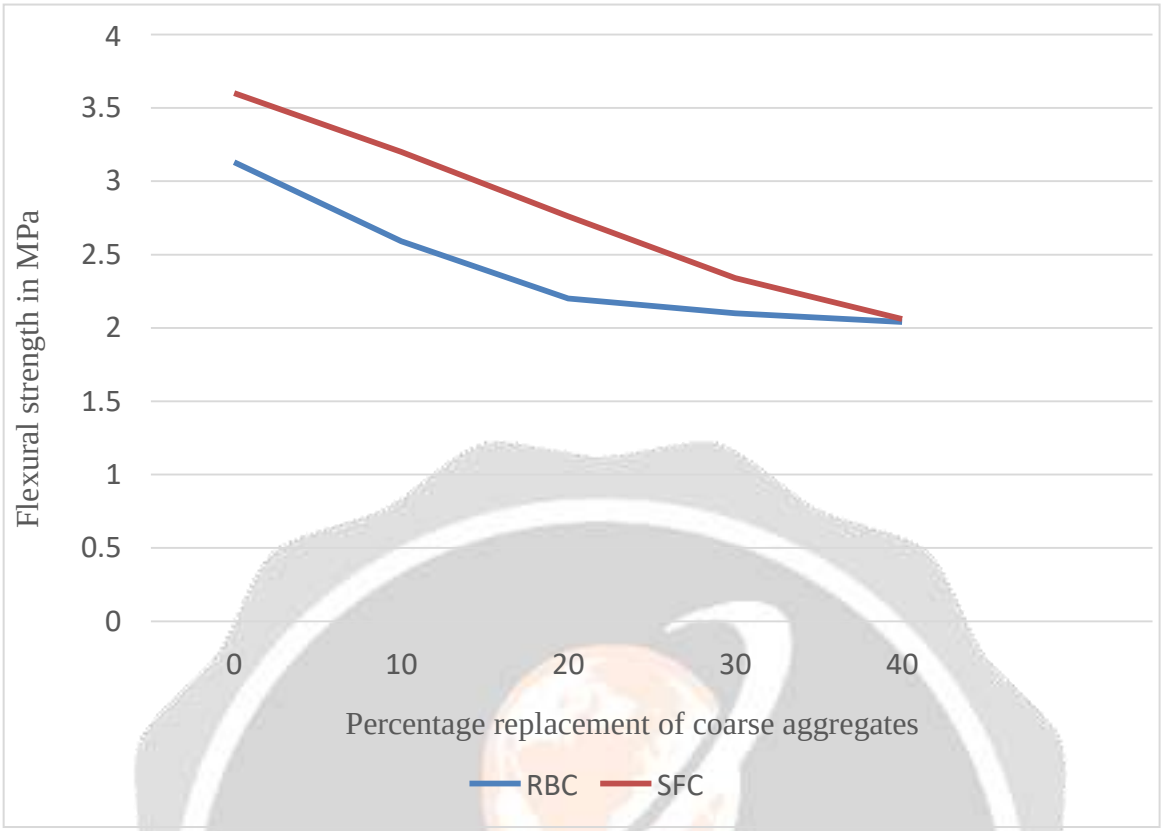

Figure.7 Graph showing flexural strength for 28 days

4. CONCULSIONS

1) The properties of tyre rubber make it proper ingredient for the problem of disposal and for preparation of concrete.

2) There is a decrease in density of concrete when replacement of rubber is increased, so it can be used as a light weight aggregate

3) The compressive strength, split tensile strength and flexural strength of Recron fiber concrete and rubber concrete goes on decreasing as the replacement of rubber increased.

4) when replacement of 10% is done there is nearly 33% rise in compressive strength of rubber concrete with 2% Recron fiber when compared to rubber concrete for 7 and 28 days.

5) Rubber concrete with 2% Recron fiber accounts for 20% increase in flexural strength compared to concrete with 10% replacement of rubber for 7 and 28 days.

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