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A Study on Rubberized Concrete

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Abstract: **The use of scrap tyre rubber in the preparation of concrete has been thought as an alternative disposal of such waste to protect the environment. In this study an attempt has been made to identify the various properties necessary for the design of concrete mix with the coarse tyre rubber chips as aggregate in a systematic manner. In the present experimental investigation, the M25 grade concrete has been chosen as the reference concrete specimen. Scrap tyre rubber chips, has been used as coarse aggregate with the replacement of conventional coarse aggregate Concrete is one of the most popular building materials. The construction industry is always increases its uses and applications. Therefore, it is required to find alternative materials to reduce the cost of concrete. On the other hand, Non-biodegradable waste i.e. water bottles, cool drink bottles and disposable glasses, shredded or crumbed rubber etc., is creating a lot of problems in the environment and its disposal becoming a great difficulty. The objective of this paper is to investigate the use of rubber pieces as coarse aggregate in the concrete. Concrete tested with varying percentages of rubber from 0 to 15% of normal aggregates. Compressive strength, of concrete is measured and comparative analysis is made.**

Key Words: Scrap tyre rubber, concrete mix, aggregate, Non-biodegradable waste, Compressive strength.

I. INTRODUCTION

About 11 Million all types of new vehicles are added each year to the Indian roads. They increases of about 10 Million discarded tyres each year pose a potential threat to the environment. The scrap tyre rubber and plastic can be considered as a non-decaying materials that disturb the surrounding environment. However, a positive method for disposing of this non-decaying material, such as reuse in concrete mixes, would have a beneficial effect. If tyres are reused as a construction material instead of being scrap, the unique properties of tyres can once again be exploited in a beneficial manner. In this context, the use of tyre chips in concrete is considered a potential Significant avenue. Thus, the use of scrap tyres in concrete manufacturing is a necessity than a desire.

The intension of this experimental study is to using crumb rubber as aggregate in cement concrete.

A review of recent research has shown that it is possible to use industrial waste material in the concrete preparation as replacement of aggregate. The waste tyre crumb rubber was used as an alternative of coarse aggregate and its properties were investigated.

So in such cases waste materials are used to modify the mechanical and Durability properties of concrete to make it suitable for any situation. It reduces the cost, save energy, promoting ecological balance and conservation of natural resources. Extensive investigations on wastage recycling are being implemented to minimize the environmental damages.

Investigation shows that used tyre do not decompose under environmental condition, so burning is the only the choice for their decomposition, which causes harmful pollution.

On the basis of experiments, we can use these crumb rubber tyres in concrete as coarse aggregate. However, this may decrease the compressive strength of concrete which will be compensated by adding nano-silica to the rubber containing concrete.

II. OBJECTIVE OF THE STUDY

The objective of this study is to test the properties of concrete when shredded or crumbed rubber used as aggregate by partial replacement of natural aggregates.

The parameters of this investigation include the compressive strength of concrete specimens cubes of 150mm X150mm X150mm size.

M25 grade concrete is used for testing and percentages of rubber aggregates are 0%,5%, 10% and15% of normal aggregates. The natural aggregates are replaced by rubber aggregates on the volume basis. The strength performance of modified concrete specimens was compared with the conventional concrete.

The parameters of this investigation include the compressive strength and workability of concrete.

III. MATERIALS

1-Cement – Confirming to IS 8112-1989 OPC of **grade 43** was used in this experiment.

Cement is a binding material use in construction to bind other materials like coarse and fine aggregate.

2-Fine Aggregate- When the aggregate is pass through the 4.75mm sieve, it is called fine aggregate.

Fine aggregate use as an inert material and also fill the voids of concrete and improve the workability.

3-Coarse Aggregate- The aggregate that retain on 4.75mm sieve, it is called coarse aggregate. It reduces shrinkage and occupies the 70-80% volume of concrete.

4- Crumb Rubber- Crumb rubber is recycle rubber,

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produce from automotive and truck scrap. Crumb rubber is often used in artificial turf as cushioning.

5-Water- Water is use as a lubricant, cleaning agent, sealant, heat transfer medium, as a solvent, and air pollution control medium.

IV. METHODOLOGY

These steps are followed during the research

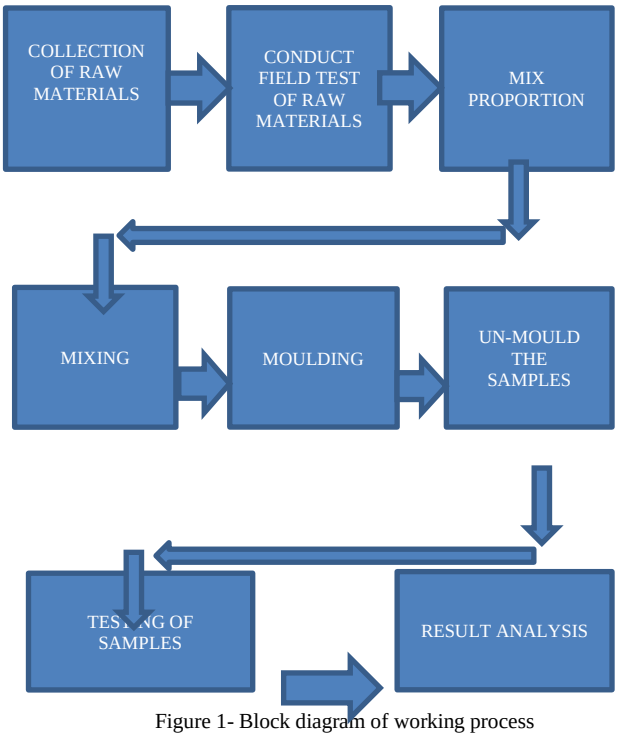

Figure 1- Block diagram of working process

V. LABORATORY EVALUATION

1. Slump Test-

Slump test measures the consistency of fresh concrete before it harden.
To find out the workability of fresh concrete, slump test is conducted.

Figure 2- Slump test apparatus

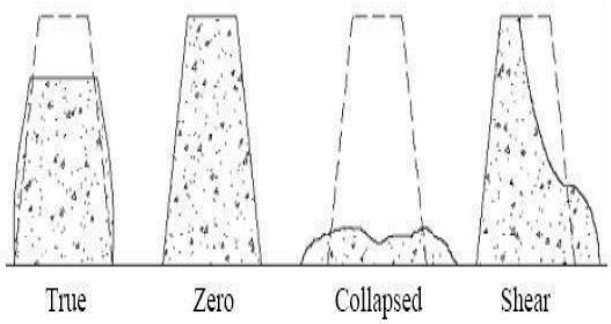

Figure-3 Different slump of concrete

Table-1 Slump value for different ratio of rubber crumb

Specimen	% of Rubber Crumb	Slump (mm)
A_1	0	92
A_2	5	60
A_3	10	29
A_4	15	5

2. Compressive Strength Test-

Compressive Strength of the concrete is a measure of the concrete's ability to resist the load which tend to compress it. Compressive Strength can be calculated by the failure load divided by the cross sectional area resisting the load.

Table-2 Compressive strength for different percentage of rubber crumb

Specimen	% of rubber crumb	Actual compressive strength (mpa)		Avg. compressive strength (mpa)	
		7 Days	28 Days	7 Days	28 Days
A1	0	19.20	25.18	18.32	22.67
		18.53	21.41		
		17.25	21.43		
A2	5	18.66	43.88	18.57	38.04
		18.35	33.62		
		18.70	36.62		
A3	10	17.22	34.02	16.57	31.78
		16.91	31.11		
		15.58	30.24		
A4	15	15.89	28.50	14.83	26.66
		14.70	26.20		
		13.90	25.30		

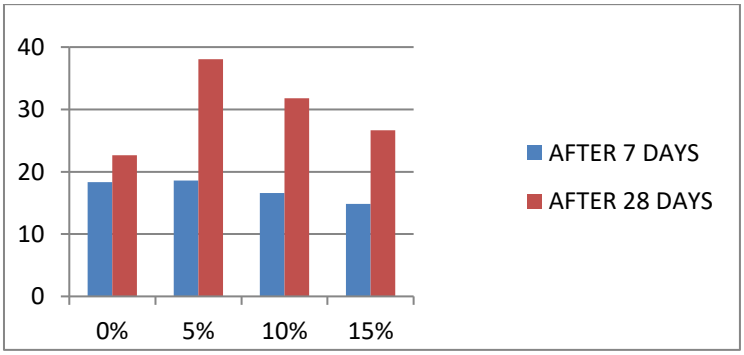

Figure-4 Compressive strength for different ratio of crumb rubber after 7 days and 28 days curing.

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VI. RESULT

By the study of different experiments following results are achieved-

1. Slump value is decreased as the percentage of scrap tyre rubber increased, so it decreases the workability of concrete.

2. The result obtained by the compressive strength test of concrete represent that the compressive strength increases with the increasing percentage of rubber crumb in the concrete.

3. At 5% replacement of rubber crumb to aggregate gives maximum strength of concrete.

4. Due to replacement of the aggregates by rubber particles, the weight was reduced.

VII. CONCLUSION

- This research indicate that there is a great potential for utilization of waste tyres rubber in concrete mix in different percentages varying from 5% to 10%.
- Rubber waste can be used with non-structural concrete such as light weight concrete or fill concrete.
- This research was done by preparing single graded rubber aggregate of size 20mm. The effect of different sizes should be study in future.

VIII. ACKNOWLEDGMENT

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