EXPERIMENTAL INVESTIGATION ON EFFECTIVENESS OF WASTE SHREDDED RUBBER TYRE AS PARTIAL REPLACEMENT FOR FINE AGGREGATE IN CONCRETE

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Abstract
The following paper deals with the study on possibility of effective utilization of waste shredded rubber tire material as partial replacement for fine aggregate in concrete. This type of concrete can be successfully used for slab construction which is subjected to lighter loads. The percentage replacement implemented in the current study are 2.5%, 5%, 7.5%, 10% by keeping the water to cement ratio constant. The possibility of usage of these aggregates as a substitute for sand was ensured based on the comparative experiments conducted. The tests on mechanical properties and physical properties were conducted on concrete specimens.
Keywords: **Compressive strength, concrete, tire waste, waste shredded rubber tire aggregates (WSRTA).**

I. INTRODUCTION

World population is increasing day by day in rapid rate due to this there is lift up in the demand for safe and aesthetic infrastructural facilities. It's the human necessities which tend to development of innovative methods in construction field. As population and demand raise parallel to each other and supply fails to reach the targets there occurs an imbalance. This idea of population, demand and supply when applied in construction field one can observe the conflict that exist between nature and infrastructural development

The dumping of tires has become a reason for fuss both locally and globally. Tires are manufactured by-products obtained during refining of petroleum when these are burnt in open atmosphere they release gases which are toxic in nature. These gases not only pollute air but also get dissolved in water and prove to be fatal for aquatic life forms [1].

In the present study carried out the waste tires were used in the form of fine aggregates obtained from cryogenic grinding of tire waste. The following paper aims at effective way of utilizing tire waste in construction practices and intends at obtaining the optimal value of replacement for fine aggregates.

II. SCOPE AND OBJECTIVES

- Use of WSRTA (Waste shredded rubber tire aggregates) as partial replacement for fine aggregates can be demonstrated as environmental friendly as it reduces the trouble of waste tire disposal.
- To determine the physical and mechanical properties of concrete with WRSTA.

III. EXPERIMENTAL WORK

The grade of concrete used for the current study is M25 and design was prepared as per is 10262:2009.The nominal mix was designed with slump value ranging from 75-100mm. 0.40 was the water cement ratio adopted throughout the experimental phase. The fine aggregate was replaced by WSRTA with 2.5%,5%,7.5% and

10% by weight and specimens were casted. The casted specimens were cured in room temperature.

A. Cement

53 grade Ordinary Portland cement (ACC Brand) is used for present study.

Table I Preliminary test results of cement

SL.NO	Properties	Results
1	Normal consistency	30%
2	Specific Gravity	3.10
3	Initial setting time	110 Min.
4	Final setting time	270 Min.

B. Fine Aggregates

Fine aggregates used in this study were of 4.75mm down size.

Table II Preliminary test results of Fine aggregates

SL.NO	Particulars	Test Results
1	Specific Gravity	2.56
2	Water absorption	1.50%
3	Fineness Modulus	2.806
4	Zone	Zone-II

C. Coarse Aggregates

Coarse aggregate of 20 mm down size were used.

Table III Preliminary Test results of coarse aggregates

SL.NO	Particulars	Test Results
1	Type of aggregate	Crushed angular
2	Specific Gravity	2.71
3	Water absorption	0.4%
4	Fineness Modulus	3.75
5	Surface Moisture	Nil

D. WSRTA (Waste shredded rubber tire aggregates)

The sizes of aggregates used were of 4.75mm down size.

Table IV Properties of WSRTA

Material	Specific gravity
WSRTA	0.52

IV RESULTS AND DISCUSSIONS

A. Compressive strength

Compressive strength on concrete moulds were tested in 200T capacity compression testing machine

Specimen	30 cubes (3 each for every percentage)
Testing Duration	7 days, 28 days
Mode Of Mixing	Drum mixer was used
Curing	Specimens were cured in room temperature

Table V Compressive strength

% Replacement	Compressive strength (N/mm^2)	
	7 days	28 days
2.50	27.11	23.11
5.00	17.77	27.55
7.50	23.11	21.77
10.00	24.44	20.00

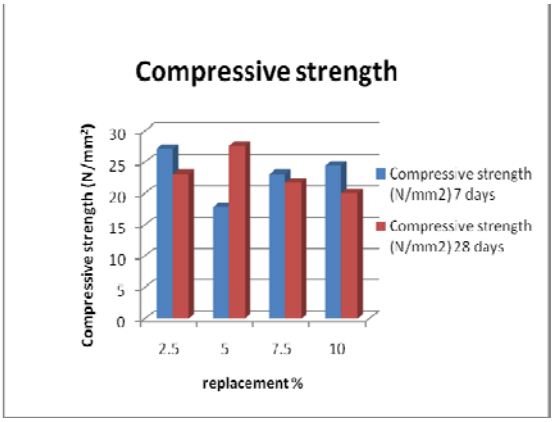

Fig 1 Compressive strength

B. Water absorption

It was carried out as following:-

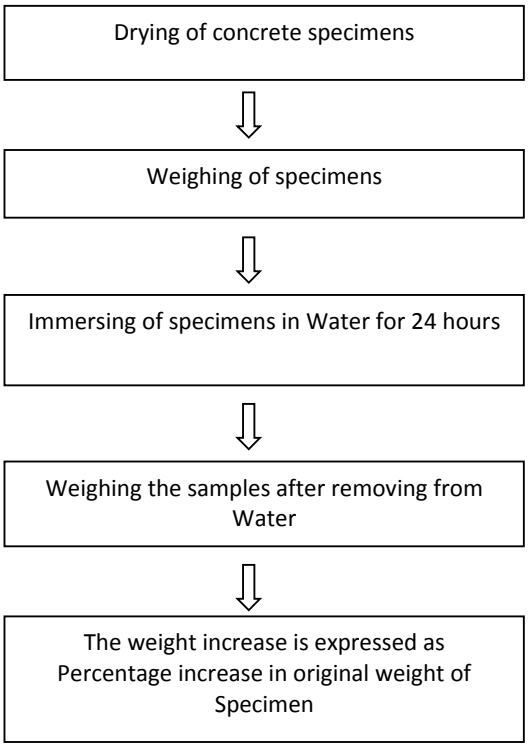

Table VI Water absorption characteristics

Percentage replacement (%)	Water absorption (7 days)	Water absorption (28 days)
0.00	5.20	5.60
2.50	3.35	3.10
5.00	2.76	250
7.50	2.37	2.30
10.00	2.25	2.00

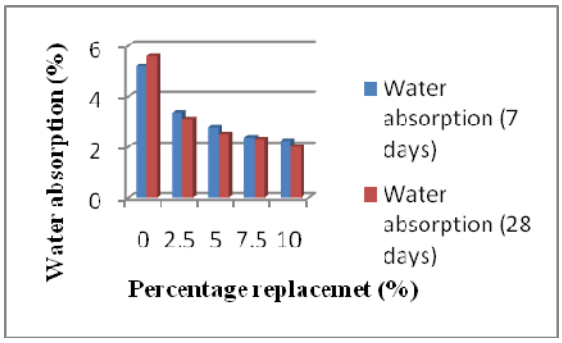

Fig 2 Water absorption v/s Percentage replacements

It is observed from the results that absorption decreases with increase in the dosage of WSRTA (Waste shredded rubber tire aggregates). This show there exist inverse relation between them.

C. Slump value

The measure of concrete consistency which is one of the important properties of fresh concrete is evaluated based on slump test. From the works carried out it was found that as the dosage of WSRTA increased the workability of the mix showed an increase, this shows that for obtaining of consistent mix WSRTA can be used as a replacement for fine aggregates**.**

Table VII Slump characteristics

Percentage replacement (%)	Slump value (mm)
0.00	100
2.50	103
5.00	105
7.50	108
10.00	110

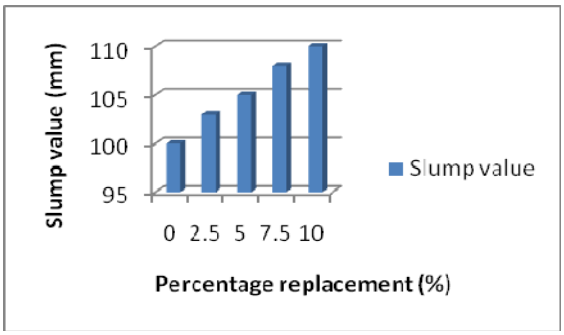

Fig 3 Slump value v/s percentage replacements

V. CONCLUSIONS

- The compressive strength was observed to gradually increase after 28 days only in the case of 5% replacement for fine aggregates with respect to other percentages in reference with normal concrete. Hence 5% can be considered as optimum replacement.
- It is observed that flow character of concrete increased with increase in the rubber dosage.
- Rubber being a non absorbent of water when added to concrete showed the reduction in absorption with raise in the rubber dosage.

- As the test results obtained for 5% of replacement of fine aggregate with WSRTA was satisfactory the following can be adopted in concrete production.

REFERENCES

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