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# STUDY ON EARLY AGE STRENGTH OF RUBBER TYRE WASTE AND E-WASTE CONCRETE AS PARTIAL REPLACEMENT OF FINE AND COARSE AGGREGATES

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## ABSTRACT:

Concrete as a partial replacement of rubber tyre as fine aggregate and e-waste as coarse aggregate. At present the disposal of waste tyres and e-waste is generated more in the world it causes environment.To reduce the waste, recycled waste material is using in construction site for example: Rubber tyre , Electronic plastic waste, etc., This has an additional advantage of saving in natural aggregates used in production of concrete which are becoming increasingly scarce. Our present study aims to use of waste rubber tyre as partial replacement of coarse aggregate to produce rubberize and e-waste concrete in M30 grade of mix. An experimental investigation is carried out on a concrete containing waste rubber tyre and e-waste in the range of 0%, 10% and 20%by weight for fine aggregate and coarse aggregate was replaced by Rubber tyre waste and Electronic waste. Material is to be produced, tested and compared with conventional concrete in terms of workability and strength. These tests were carried out on standard cube of 150×150×150mm for 3days and 7days to determine the early age compressive strength of concrete. The results shows that 10% of rubber waste and e-waste gives higher compressive strength and durability performance so it considered as light weight. As a result it was found that rubberized concrete is durable, less ductile has a greater crack resistance but has low compressive strength when compared with conventional concrete.

**Keywords:** E-wate, Recycled rubber tyre waste, Aggregate replacement, Compressive strength.

# I. INTRODUCTION

Waste tyres have presented a pressing global issue for the environment, as a result of a growing use of road transport vehicles.Rapid growth in automobile industry and increasing use of vehicles, production of tyre is also increased which generate waste tyre rubber.On the other hand, demand of concrete as construction When we compared waste rubber mixture is to normal concrete is more workable and also it is useful in making light weighted aerated concretes. Non structural applications are mainly required usage of rubberized concrete. In this study, the rubber aggregates are prepared mechanically by cutting the tyres to maximum normal size equal to 20mm and after cleaning with portable water kept for air drying. For usage waste tyres in civil engineering is currently very low and its one of the largest potential routes in construction. Depends on its examinations, another way is using the tyres in concrete material from society, it is needed to preserve natural coarse aggregate by using alternative material. In this research, reuse of waste tyre rubber powder in concrete as partial replacement as fine aggregate and the electronic waste in concrete as a partial replacement as coarse aggregate.

The main objectives of this study is,

- ✓ Observation of some physical properties of concrete mix contained from waste tyre aggregates.
- ✓ Compressive strength of concrete mix using different percentage replacement in water curing.
- ✓ Comparing and discussion of test results obtained from rubberized and e-waste concrete in various mixes.

## II. MATERIALS

Cement : OPC 53 gradeused.

Specific gravity

Fine Aggregate: River sand used.

Specific gravity = 2.565

Coarse Aggregate:Crushed stones used.

Specific gravity =2.715

Water: Portable water used.

PH 7 to 8

Fig.1. Rubber tyre powder

Rubber tyre :Tyre powder used.

Specific gravity = 1.13

0, 10 & 20% replace by FA

Electronic :20mm size used.

Specific gravity =1.9

0,10&20% replace

Fig.2. Electronic waste

## III. Experimental Setup:

- In this experimental investigation consists of 3 different mix proportions by replace coarse aggregate in 0, 10 and 20% of waste rubber tyre and e-waste in M30 grade concrete.
- Total numbers of 18 cubes (150×150×150mm) were casted for durability test as well as optimum compressive strength test. After that cubes were immersed in water to the curing.
- Compressive strength test was performed at the age of 3 and 7 days and durability test at age of 28 days curing. Compressive strength calculated by using compressive strength machine,
- Density also conducted after 28 days for light weight concrete properties.

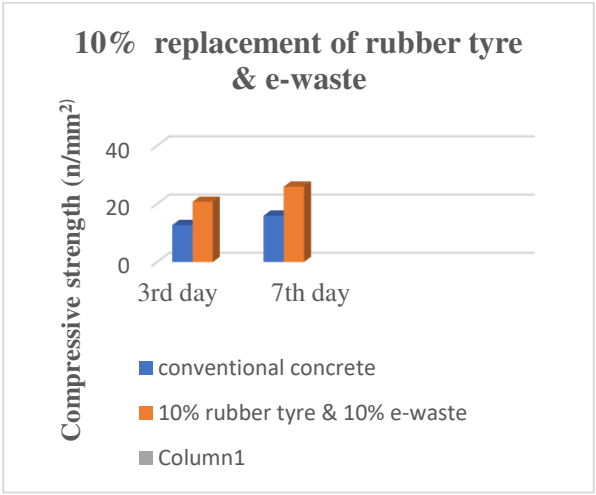
## IV. RESULTS AND DISCUSSION

### A. Workability of Concrete:

TABLE 1. WORKABILITY OF CONCRETE

| % Replacement of waste rubber tyre& E-waste | Slump Value (mm) |
|---|---|
| Conventional Concrete | 85 |
| 10% | 80 |
| 20% | 60 |

Table 1 shows that, Slump value of fresh concrete has been decreased due to increase in percentage of waster rubber tyre and e-waste chips in all replacement of concrete mix




**GRAPH 1.** COMPARISON OF RESULTS OF NORMAL CONCRETE WITH 10% REPLACEMENT OF RUBBER TYRE & E-WASTE

### B. Comparison of results of normal concrete with 10% replacement of rubber tyre& e-waste:

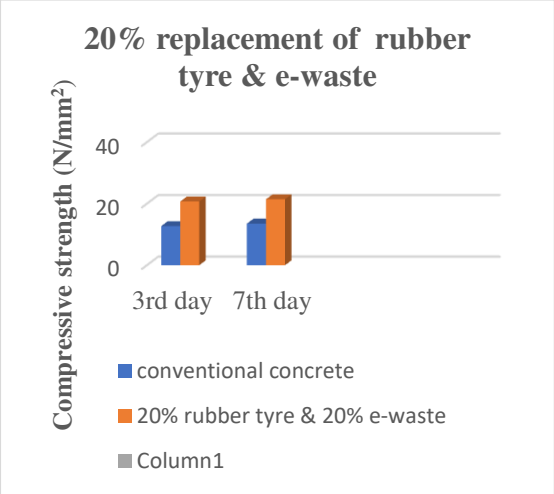
TABLE 2.

| S.NO | SPECIMEN | COMPRESSIVE STRENGTH (N/mm²) | |
|---|---|---|---|
| | | 3RD DAY | 7TH DAY |
| 1 | CC | 12.7 | 20.7 |
| 2 | 10% RUBBER TYRE & E-WASTE | 15.9 | 25.9 |

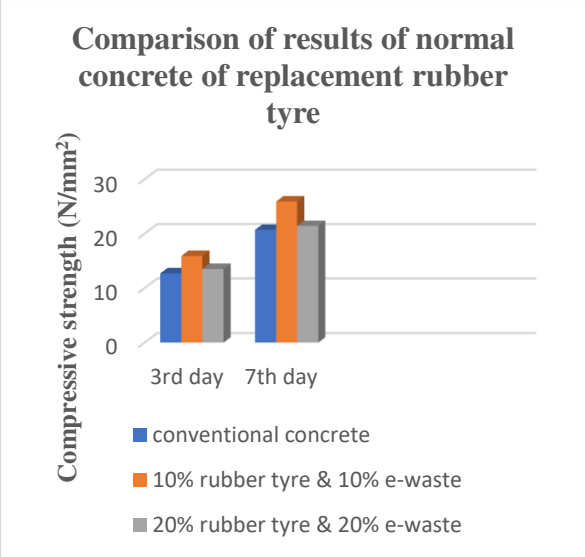
### C. Comparison of results of normal concrete with 20% replacement of rubber tyre & e-waste

TABLE 3.

| S.NO | SPECIMEN | COMPRESSIVE STRENGTH (N/mm²) | |
|---|---|---|---|
| | | 3RD DAY | 7TH DAY |
| 1 | CC | 12.7 | 20.7 |
| 2 | 20% RUBBER TYRE & E-WASTE | 13.5 | 21.4 |




**GRAPH 2**. COMPARISON OF RESULTS OF NORMAL CONCRETE 20% REPLACEMENT OF RUBBER TYRE & E-WASTE




**GRAPH 3**. COMPARISON OF RESULTS OF NORMAL CONCRETE OF REPLACEMENT OF RUBBER TYRE & E-WASTE

## D. COMPARISON OF RESULTS OF NORMAL CONCRETE OF REPLACEMENT OF RUBBER TYRE & E-WASTE

| SPECIMENS | 3rd DAY COMPRESSIVE STRENGTH ($N/mm^2$) | 7th DAY COMPRESSIVE STRENGTH ($N/mm^2$) |
|---|---|---|
| CC | 12.7 | 20.7 |
| 10% RUBBER TYRE &10% E-WASTE | 15.9 | 25.9 |
| 20% RUBBER TYRE &20% E-WASTE | 13.5 | 21.4 |

## V. SCOPE FOR FUTURE STUDY

- Many scientists conducted their experimental work by replacing fine aggregate with rubber aggregate, likely because of the better results that were obtained from experiments with fine aggregate replacement as compared to results obtained with coarse aggregate replacement.
- On behalf of future investigations, it can be suggested that experimental investigations of concrete properties should be investigated with fine aggregate replacement, perhaps with even smaller rubber particles such as waste tire powder.
- From relationship between overviewed fresh and hardened properties of concrete with number of analysed test results for each property depending on concrete type it can be concluded that further experimental work on properties of self-compacting rubberized concrete still needs to be conducted, because of its high potential to be used in structural applications

## VI. CONCLUSION:

The following conclusions have been drawn from research on using rubber and e-waste as aggregates. Addition of waste rubber tyre and e-waste into normal concrete mix leads to decrease in workability for the various mix strength.

- The compressive strength increased by **25.20 % for 3 days** and **25.12 %** for **7 days** in conventional concrete and 10% replacement of rubber tyre and e-waste concrete respectively.
- The compressive strength of conventional concrete and 10% replacement of rubber tyre and e-waste concrete at **3 days are 12.7N/mm$^2$** and **15.9 N/mm$^2$** and at **7 days** are **20.7 N/mm$^2$**and **25.9N/mm$^2$**.
- The compressive strength of 10 % partial replacement of rubber tyre and e- waste concrete has slightly higher value than 20 % partial replacement of rubber tyre and e-waste concrete.
- The value decreased by **15.09% for3 days** and **17.40 % for 7 days** from 10 % replacement to 20 % replacement.

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