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STUDY ON MECHANICAL PROPERTY OF COPPER SLAG AND JUTE FIBER WITH DIFFERENT GRADES OF CONCRETE

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ABSTRACT

The research on copper slag and jute fiber has been done to study the construction. From past 20 years many researchers are proved that the usage of copper slag as a replacement in concrete will be possible due to same granular size of copper likely as of fine aggregates. This project aim study the structural behavior of reinforced concrete with copper slag and jute fiber their application in concrete strength. In experimental investigate copper slag is replacement by fine aggregate by adding o% to 40% of copper slag and overall addition of 0% to 1.5% of jute fiber. The compressive and tensile strength of concrete increase with structural behavior of concrete. Through these results of trial 1 is maximum value are 20% of copper slag and 0.5 % jute fiber through these results going to cast a beam of conventional and mix proportions. And project aim is to achieve a M80 grade of concrete strength in a beam. In a beam the flexural strength is going to be tested to achieve and M80 grade of concrete. There are so many researches are carried around the globe on the usage of copper slag as replacement material, but in India a very few researches are carried.

Keywords: copper slag, jute fiber, compressive strength, split tensile strength.

1. INTRODUCTION

1.1 General

In now days many research is using a copper slag are replacement of fine aggregates which increase compressive strength. And jute fiber is additional adding of concrete which increase a crack width. So many research is going thorough this related work.

1.2 Objective of the Study

- To examine the mechanical property of the materials (Natural fiber, copper slag).
- To examine the feasibility of using natural fiber and Copper slag in conventional beam.
- To compare the flexural behavior of conventional beam With RC composite beam.

1.3 Scope of the Project

- Casting of cubes, cylinder to study the mechanical property of the natural fiber and copper slag.
- Casting of conventional beams of size 1200 x 250 x250 mm to study the flexural behavior.
- Casting a beam using optimized quantity of natural fiber and copper slag of flexural behavior.

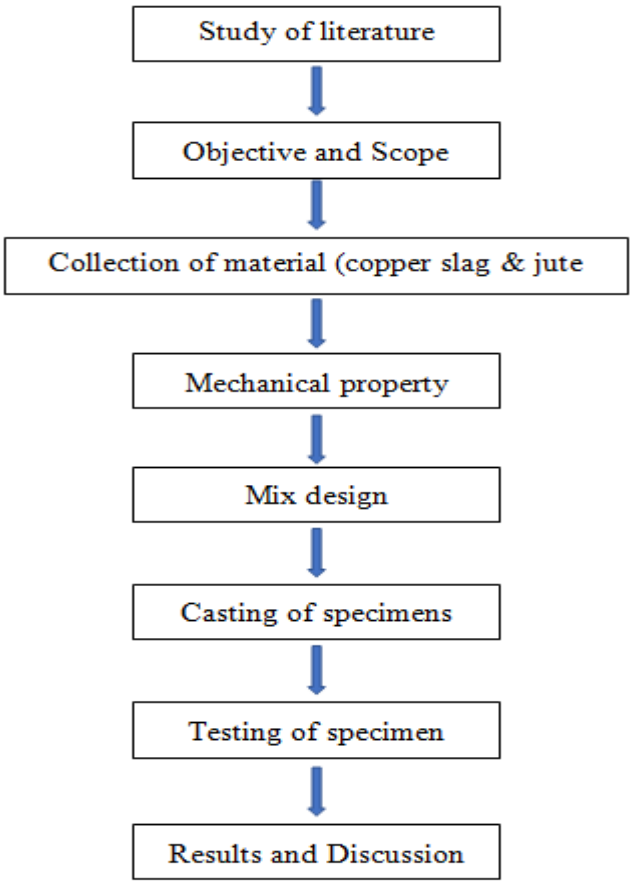
1.4 Need for this Study

In this research, M80 grade of concrete can be achieved by using copper slag and Jute fiber. So, the percentage of copper slag increases the workability. It is observed that up to 20% replacement of natural sand can be replaced by copper slag therefore the flexural strength of concrete is increased by 14%.

2. METHODOLOGY

2.1 General

The methodology flow chart which explains the procedure follows in whole project that from start to end.



3. MATERIALS

3.1 Copper Slag

In the production of concrete, Copper slag can be used as a partial alternative to natural sand in some instances. Copper slag is formed into stones and used for construction. In areas where burning was done, fumed highly settled crystalline copper slag from the Participating parties copper smelter was widely used as road-building material. Granular slag's heating and drainage properties can be employed to avoid floor frost inside this winter, which could lead to cracks in the pavement Copper slag used in this work was bought from Sterlite industries (India) ltd, Tuticorin, Tamil Nadu, India.

Figure-1. Copper slag.

3.2 Jute Fiber

Jute Fiber Reinforced Concrete (JFRC) is a composite material consisting of concrete and short discrete natural jute fibers. As a result, extensive research has been conducted to integrate naturally accessible jute fiber in a concrete matrix to create a composite building material.

Figure-2. Jute fiber.

3.3 Specimen Used

Cube of size 100 x 100 x 100 mm was used for making conventional concrete. Cylinders of 100 mm diameter and 200 mm height had been considered for making conventional concrete.

3.4 Cement

The cement used for this study is Portland Pozzolanic Cement is conforming to Indian Standard IS 12269 - 1987 of grade 53. Specific gravity of cement, Fineness test, Consistency and Setting time of cement were determined and the values are shown in Table-1.

Table-1. Test on cement.

Test	Results
Specific gravity of cement	3.14
Fineness of cement	10
Consistency of Cement	31%
Initial Setting time of Cement	35 min

3.5 Fine Aggregate

The sand is used as fine aggregate and it is collected from nearby area. The sand has been sieved in 4.75 mm sieve. Specific gravity of Fine Aggregate and its Fineness were determined and the values are shown in Table-2.

Table-2. Test on fine aggregate.

Test	Results
Specific gravity of Fine aggregate	2.66
Fineness of Fine aggregate	2.14
Bulk density value	1.73
Sieve analysis zone	Zone -II

3.6 Coarse Aggregate

The coarse aggregate is chosen by shape as per IS 2386 (Part I) 1963, surface texture characteristics of aggregate is classified as in IS 383 - 1970. The maximum size of aggregate taken is 10 mm. Specific gravity of coarse aggregate, Fineness, Impact Value and the Crushing value of Coarse Aggregate were determined, and the values are shown in Table-3.

Table-3. Test on coarse aggregate.

Test	Results
Specific gravity of Coarse aggregate	2.87
Fineness of Coarse aggregate	3.1
Impact value of Coarse Aggregate	21.4%
Crushing value of Coarse Aggregate	26.84%

4. EXPERIMENTAL INVESTIGATION

4.1 Compression Test

Compression strength of concrete f_{ck} = Load applied on the cube specimen / Gross area of the cube. Table-4 shows the test of compressive strength of concrete

at 7 days for various mix of copper slag and jute fiber in M80 grade of concrete.

Figure-3. Compression strength test.

Table-4. Compression strength of concrete at 7 days.

Description(M80)	Compressive strength (N/mm^2)
CC	22.5
C.S 20%, J.F 0.5%	32.72
C.S 30%, J.F 1%	31.38
C.S 40%, J.F1.5%	38.4

Table-5. Shows the test of compressive strength of concrete at 14 days for various mix of copper slag and jute fiber.

Description (M80)	Compressive strength(N/mm^2)
CC	34.5
C.S 20%, J.F 0.5%	41.83
C.S 30%, J.F 1%	38.76
C.S 40%, J.F 1.5%	40.87

Table-6. Compression strength of concrete at 28 days.

Description(M80)	Compressive strength (N/mm^2)
CC	82.36
C.S 20%, J.F 0.5%	94.56
C.S 30%, J.F 1%	90.2
C.S 40%, J.F 1.5%	92.84

4.2 Split Tensile Strength Test

Split tensile strength of concrete was tested for 7 days were conducted and the results are shown in Table-7. Split tensile strength of concrete was tested for14 days were conducted and the results are shown inTable-8

Figure-4. Split tensile tests.

Table-7. Split tensile strength of concrete at 7 days.

Description(M80)	Split tensile strength (N/mm^2)
CC	2.7
C.S 20%, J.F 0.5%	2.88
C.S 30%, J.F 1%	2.76
C.S 40%, J.F 1.5%	2.62

Table-8. Split tensile strength of concrete at 14 days.

Description(M80)	Split tensile strength (N/mm^2)
CC	3.46
C.S 20%, J.F 0.5%	3.73
C.S 30%, J.F 1%	3.64
C.S 40%, J.F 1.5%	3.53

Split tensile strength of concrete was tested for 28 days were conducted and the results are shown in Table-9.

Table-9. Split tensile strength of concrete at 28 days

Description (M80)	Split tensile strength (N/mm^2)
CC	3.93
C.S 20%, J.F 0.5%	4.28
C.S 30%, J.F 1%	4.18
C.S 40%, J.F 1.5%	4.23

4.3 Testing of Copper Slag and Jute Fiber

The copper slag and jute fiber specimens that were casted for M80 concrete, copper slag @ 20%, 30%, 40% and jute fiber @ 0.5%,1%,1.5%. copper slag is replacement of fine aggregate were cured for 7,14,28 days. They were tested for the compressive strength and split tensile test.

4.4 Comparison on Different Trial Mix in Graphical Presentation

In graphical presentation of cube (100 x 100 x 100 mm) were tested on 7, 14, and 28 days. High strength concrete which we achieved on 7, 14, 28 days is show in figure on grade of M80 with copper slag and jute fiber.

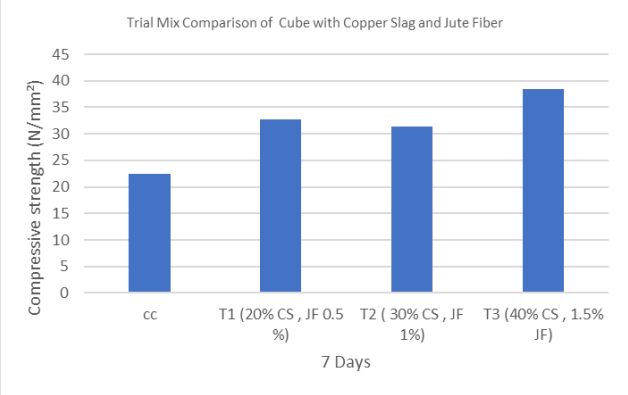


Figure-5. Graphical presentation of cube mix in 7 days.

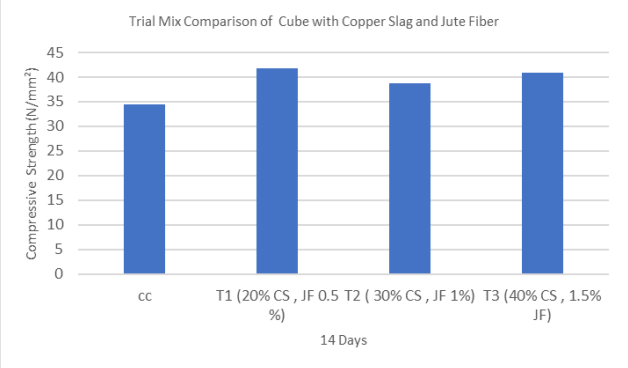


Figure-6. Graphical presentations of cube on 14 days.

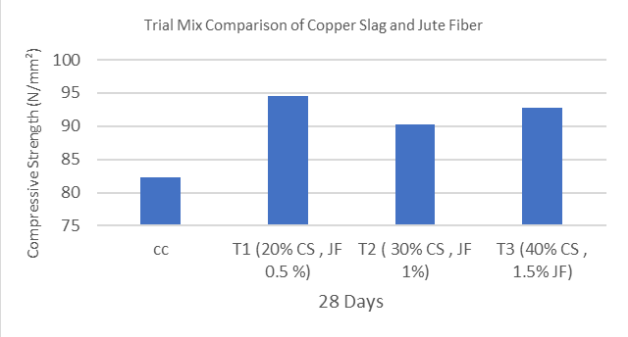


Figure-7. Graphical presentations of cube on 28 days.

4.5 Comparison on Different Trial Mix in Graphical Presentation

In graphical presentation of cylinder was a dia 200 mm and 100 heights were tested on 7, 14, and 28 days. High strength concrete which we achieved on 7, 14, 28 days is show in figure on grade of M80 with copper slag and jute fiber.

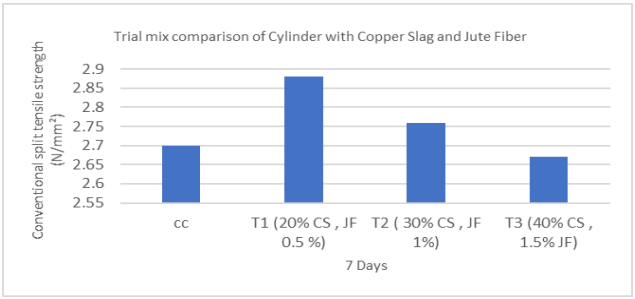


Figure-8. Graphical presentations of cylinder on 7 days.

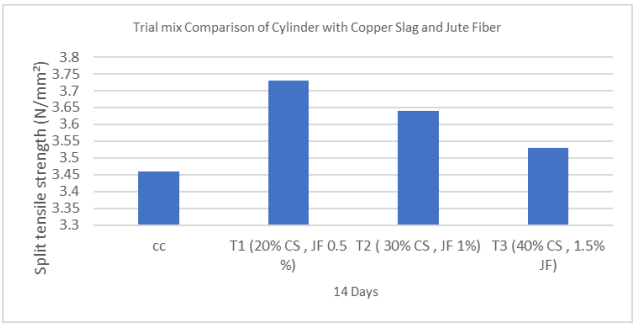


Figure-9. Graphical presentations of cylinder 14 day.

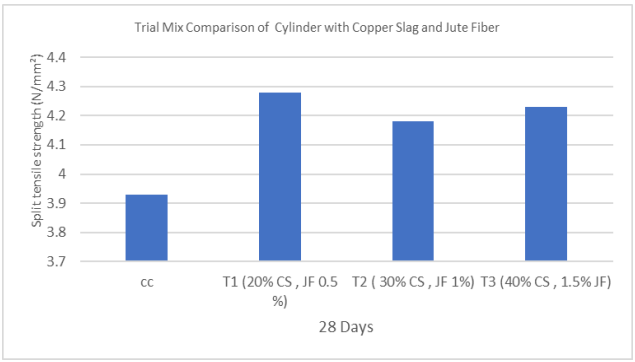


Figure-10. Graphical presentations of cylinder 28 days.

5. CONCLUSIONS

Based on the investigations, the following conclusions were drawn.

- The use of copper slag in concrete has significant environmental and technological benefits for all businesses involved. The cost of manufacturing concrete is reduced when copper slag is partially replaced in fine aggregate and cement.
- The self-weight of concrete specimens increases to a maximum of 15-18% when copper slag is replaced (100 percent replacement with sand).
- In jute fiber is overall addition on concrete it increases a crack width.
- The results of compressive, split tensile strength test have indicated that the strength of concrete increases

with respect to the percentage of copper slag and jute fiber.

- In trial mix of M80 high strength concrete we have trial cube and cylinder are casted and tested in 7 days, 14 days, 28 days.
- From the results of trial mix of M80 grade of concrete in compressive strength as achieved in T1 (copper slag 20%, jute fiber 0.5%).
- In M80 grade of concrete, split tensile strength as achieved in T1 (copper slag 20%, jute fiber 0.5%).
- From this M80 grade of concrete was achieved.

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