International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 01 | Jan 2021 www.irjet.net p-ISSN: 2395-0072

STUDY OF CONCRETE BY PALM OIL FUEL ASH AS CEMENT, CUPOLA SLAG POWDER AS FINE AGGREGATE AND BRICKBAT AS COARSE AGGREGATE

Pondroti Shanmukha Naga Saikumar[1], Sri .K. Murali Krishna[2]

[1]M.Tech Final Year Student, Department of Civil Engineering
[2]Assistant Professor, Department of Civil Engineering, DMS SVH College of Engineering, Andhra Pradesh, India

---***---

Abstract - *Concrete is an essential material in the construction field, Aim of this project is to obtain an environmental friendly by using palm oil fuel ash & Cupola slag powder as cement and fine aggregate &overheated broken brick blocks as coarse aggregate. Concrete is a mix of aggregates, binding materials and water. Most of the aggregates are naturally obtained from gravel and river sand. Due to the modern living standards old structures need to pave way for the new modern structures, to save the ecosystem conventional aggregate is replaced fully with eco-friendly materials .Iron slag a modern waste result of steel industry. Essentially it comprises of totals which are fortified together by concrete and water. Palm oil fuel debris which is acquired by consuming palm products of the soil leaves of palm oil tree in palm oil plants is likewise used to control warmth of hydration impact on concrete, subsequent to pounding and making into a fine powder. The over consumed block broken into pieces called as block bats. These block bats are blended in with concrete slurry after 7days restoring utilized as a total in concrete. In this examination concrete is being supplanted with palm oil fuel debris in various rates (5%, 10%, 15%, 20%) to get an ideal quality specific substitution rate. By taking the above ideal quality rate the Cupola Slag is utilized by incomplete supplanting in fine total with various rates (5%, 10%, 15% and 20%) to get ideal quality. Correspondingly, from the above ideal quality Brickbat in various rates (5%, 10%, 15%, 20%) is supplanted as coarse total up to the ideal quality. The mechanical properties were concentrated by performing Compression test, Flexural test and Split Tensile test*

***Key Words*: Concrete, Palm Oil Fuel Ash, Cupola Slag, steel fibers & Brickbat and compressive strength, flexural strength and split tensile strength.**

1. INTRODUCTION

Most very used materials in the development in different methods of all affable designing works is concrete. This incorporates framework, low-and High rise building. The most of materials used in this study are recycling and eco-friendly materials

1.1 Materials and characteristics

Palm oil fuel ash: Palm oil shells (OPS) which are a framing farming strong waste, accessible mass amounts in tropical nations like Malaysia. Operations is utilized as coarse total and furthermore utilized as basic lightweight cement. The murkiness of OPS depends on the different nuts from various types of palm trees running from 0.50-8.00 mm The principle point of this work is to bring to a fruitful end to achieve a lightweight cement by supplanting OPS with rural waste in the spot of coarse total. Additionally, the GGBS is utilized as an incomplete substitution in concrete replacement. The blend configuration is finished by taking into the tally of the quality required, thickness and functionality compulsory for the particular utilization of lightweight cement. Solidness and quality are the usefulness factors for solid structure. Extraordinary critical realities are these structures are still in an acceptable condition approving the toughness of cement.

Cupola slag : Dome slag is result material which is assembled from cast iron assembling unit. It is created during dissolving of cast iron in heaters. The slag happens as a liquid fluid which cements after cooling. Vault slag is an unpredictable arrangement of silicates and oxides. Dome heater is tube shaped formed dissolving gadget which is utilized in steel businesses for softening of cast iron running from 0.5 to 4 m in measurement .Base of heater having an entryway which can swing in and out. Head of the heater is kept open. Air vent is organized to flexibly the air in Furnace. Shells of heater are comprised of steel, recalcitrant blocks. There is one slag gap from which slag comes out at higher temperature with low thickness that hardens in dark hued knots after cooling. Irregularities size shifted from 100 mm to 450 mm. Vault slag is will in general be thick strong material that fluctuates in shading from Gray to dark.

Jhama class brickbat: The over burnt brick broken into pieces called as brick bats. These brick bats are mixed with cement slurry after 7days curing used as an aggregate in concrete. The 20mm size of brickbat aggregate used in these study.

Steel fibers: Steel Fibres (Hook ended) is used in the present study. The size of fibre used in these study is 55/30 i.e., 0.55mm diameter and 30 mm length

2. SCOPE OF STUDY

The main aim of the study to determine the behavior of concrete when it partial replaced with palm oil fuel ash as cement, cupola slag powder as fine aggregate, brickbat for coarse aggregate.

- Initially, in this study cement is being replaced with palm oil fuel ash in different percentages (5%, 10%, 15%, 20%) to get an optimum strength particular replacement percentage.
- By taking the above optimum strength percentage the Cupola Slag is used by partial replacing in fine aggregate with different percentages (10%, 20%, 30% and 40%) to get optimum strength.
- Similarly, from the above optimum strength Brickbat in different percentages (5%, 10%, 15%, 20%) is replaced as coarse aggregate up to the optimum strength.
- From that optimum point the steel fibres with different percentages (0.5%, 1% & 1.5%) will be added and compared with nominal concrete.

3. PHYSICAL PROPERTIES OF MATERIALS

Table 3.1 physical properties of cement

S.No	Physical properties	value
1.	Normal consistency	30%
2	Fineness cement	3.47%
3	Specific gravity	3.15

Table 3.2.physical properties of fine aggregate

S.No	Property	values
1	Specific gravity	2.60
2	Fineness modulus	2.6
3	Grading of zone	II

Table.3.3 physical properties of coarse aggregate

S.No	Property	values
1	Specific Gravity	2.74
2	Fineness Modulus	6.6
3	Bulk Density	1.54

Table 3.4.Table of brickbat physical properties

S.No	Property	Values
1.	Specific gravity	2.2
2.	Fineness modulus	7.1

METHODLOGY:

- In M30 mix, the cement is partially replaced with palm oil fuel, fine aggregate with cupola slag & brickbat as coarse aggregate respectively
- Addition of steel fibres to optimum value of each replacement material at different proportions (0.5%, 1% & 1.5%).

Mix notations

1. **C.A- coarse aggregate**
2. **F.A-Fine aggregate**
3. **POFA-**PALM OIL FUEL ASH
4. CSP-CUPOLA SLAG POWDER
5. **BB-**BRICKBAT
6. OPC100%+C.A+F.A-**A**

7 .OPC 95%+POFA 5%+C.A+F.A-**A1**

8. OPC 90%+POFA 10%+C.A+F.A-**A2**
9. OPC 85%+POFA 15%+C.A+F.A-**A3**
10. OPC 80%+POFA20%+C.A+F.A-**A4**

CUPOLA SLAG POWDER

11. OPC 90%+POFA 10%+C.A+F.A 90%+CSP10%-**B1**
12. OPC 90%+POFA 10%+C.A+F.A 90%+CSP20%-**B2**
13. OPC 90%+POFA 10%+C.A+F.A 90%+CSP30%-**B3**
14. OPC 90%+POFA 10%+C.A+F.A 90%+CSP40%-**B4**

BRICKBAT

15. OPC 90%+POFA10%+C.A95%+BB5%+F.A90%+CSP10%-**C1**
16. OPC 90%+POFA10%+C.A90%+BB10%+F.A90%+CSP10**%-C2**
17. OPC 90%+POFA10%+C.A85%+BB15%+F.A90%+CSP10%-**C3**
18. OPC 90%+POFA10%+C.A80%+BB20%+F.A90%+CSP10%-**C4**

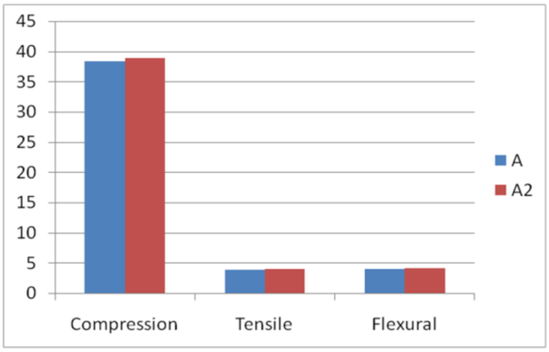
STEEL FIBRES

19. A2+0.5% SF-D1
20. A2+1% SF-D2
21. A2+ 1.5% SF-D3
22. B1+ 0.5% SF-E1
23. B1+ 1% SF-E2
24. B1+ 1.5% SF-E3
25. C3+0.5% SF-F1
26. C3+ 1% SF-F2
27. C3+ 1.5% SF-F3

Table 3.5 Mechanical properties of normal concrete(A) and palm oil fuel ash replaced concrete

Values @28 days (N/mm2)	Compressive strength	Split tensile strength	Flexural strength
A	38.3	3.89	3.94
A1	38.4	3.92	4.01
A2	38.9	4.01	4.17
A3	37.3	3.85	4.08
A4	36.2	3.81	3.97

Graph 3.1 comparison of A & A2

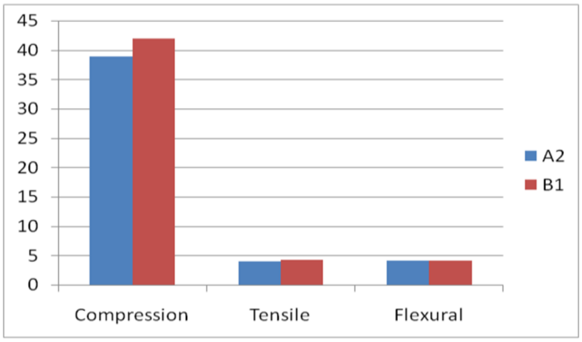


Comparison of A & A2

Table 3.6 Mechanical properties of pofa and csp replaced concrete

Values @28 days (N/mm2)	Compressive strength	Split tensile strength	Flexural strength
B1	41.9	4.2	4.23
B2	40.6	3.93	3.97
B3	37.8	3.8	3.74
B4	35.2	3.48	3.42

Graph 3.2 comparison of A2 & B1

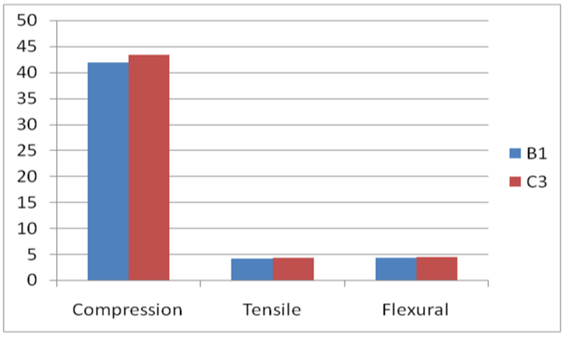


Comparison of A2 & B1

Table 3.7.Mechanical properties of palm oil fuel ash, cupola slag powder & brickbat replaced concrete

Values @28 days (N/mm2)	Compressive strength	Split tensile strength	Flexural strength
C1	42.3	4.2	4.26
C2	42.8	4.27	4.32
C3	43.4	4.31	4.36
C4	43.2	4.29	4.29

Graph 3.3 comparison of B1 & C3

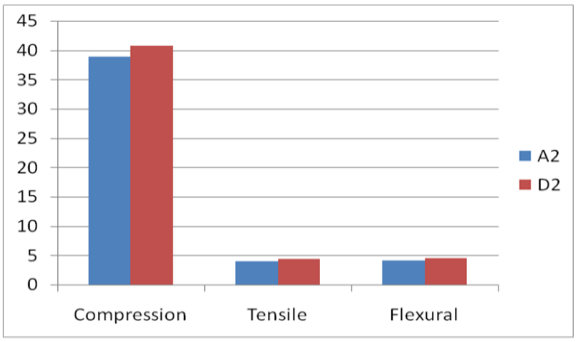


Comparison of B1 & C3

Table 3.8. Mechanical properties of concrete in addition of steel fibres to A2

Values @28 days (N/mm2)	Compressive strength	Split tensile strength	Flexural strength
D1	39.5	4.22	4.29
D2	40.8	4.37	4.51
D3	37.2	3.95	4.31

Graph 3.4 comparison of A2 & D2

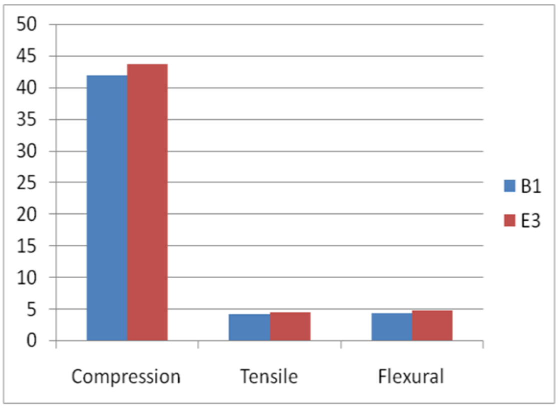


Comparison of A2 & D2

Table 3.9 .Mechanical properties of concrete in addition of steel fibres to B1

Values @28 days (N/mm2)	Compressive strength	Split tensile strength	Flexural strength
E1	42.2	4.27	4.4
E2	42.9	4.37	4.68
E3	43.7	4.46	4.71

Graph 3.5 comparison of B1 & E3

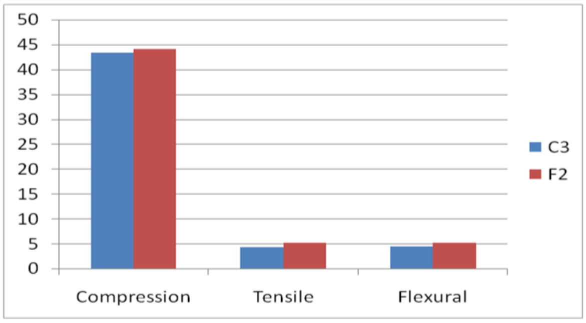


Comparison of B1 & E3

Table 3.10 .Mechanical properties of concrete in addition of steel fibres to C3

Values @28 days (N/mm2)	Compressive strength	Split tensile strength	Flexural strength
F1	43.66	4.8	4.85
F2	44.1	5.1	5.23
F3	42.9	4.6	4.51

Graph 3.1 comparison of C3 & F2



Comparison of C3 & F2

4. CONCLUSIONS

The following conclusions are drawn from the experimental results

When A and A2 are compared, A2 higher in compressive strength by 1.56%, Tensile strength 3.08%, Flexural strength by 5.83%.

Comparison of A2 & B1 results in increase of compression, tensile & flexural strength by 7.71%, 4.73%, 1.43% respectively.

By comparing of B1 & C3, we get 3.57%, 2.61%, 3.07% increase in strength's of compression, tensile & flexural respectively.

By adding steel fibers to mix A2, results in increase of tensile & flexural strength by 8.97%, 8.1% respectively.

By adding steel fibers to mix B1, results in increase of tensile & flexural strength by 6.19%, 11.3% respectively and compression strength increase by 4.29%.

By adding steel fibers to mix C3, results in increase of compressive strength by 1.61% tensile & flexural strength by 18.3%, 19.9 % respectively.

REFERENCES

[1] Apebo N.S., Agunwamba. J. C.(2014), ― The suitability of crushed over burnt brick as coarse aggregate.‖, International Journal of Engineering Science And Innovative Technology, Vol. 3, Issue-1

[2] W. Tangchirapat, T. Saeting, C. Jaturapitakkul, K. Kiattikomol, and A. Siripanichgorn, "Use of waste ash from palm oil industry in concrete," *Waste Management*, vol. 27, no. 1, pp. 81–88, 2007.

[3] Zile, E. & Zile, O., Effect of the fiber geometry on the pullout response of mechanically deformed steel fibers. Cement and Concrete Research, 44, pp. 18–24, 2013.

[4] KhaldounRahal, (2005), ―Mechanical Properties of Concrete With Recycled Coarse Aggregate‖, Building And Environmental Science, pp 407-415. 12. Khaloo, A. R. (1994). ―Properties of concrete using clinker brick as coarse aggregate.‖ ACI Mater. J., 91(4), pp. 401–407.

[5] L.ZEGICHI "the effect of replacement of natural aggregates by slag products on strength of concrete"-Asian Journal Of Civil Engineering (Building & Housing) Vol 7, No 1,2006, page 27-35 .

[6] Bazaz J.B., Khayati M., (2012) ―Properties and Performance of concrete made with recycled low quality crushed brick‖, Journal of Material in Civil Engineering. Vol.-24., pp.330-338

[7] Khalaf F.M., DevnnyA.S.,(2005), ― Properties of new and recycled clay brick aggregate for use in concrete.‖, Journal of Material in Civil Engineering., Vol.-17,pp.456-464.

[8] Mazumdar A.R., Kabir A., (2006) , ―Performances of over burnt distorted brick as coarse aggregate in pavement works.‖, Journal of material in civil engineering., Vol.-18,pp.456-464., PP.- 18 , Journal of Material in Civil Engineering., Vol.- 17,pp.777-785

BIOGRAPHIES

P.S.N.SAI KUMAR
M.Tech final year student, DMS SVH College of Engineering, machilipatnam , Krishna dist

Sri .K .Murali Krishna
Asst Professor in Civil Engineering Department, DMS SVH College of Engineering, Machilipatnam, Krishna District, A.P INDIA