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STUDY ON PARTIAL REPLACEMENT OF CEMENT BY FLY ASH, NATURAL FINE AGGREGATES BY SAWDUST, AND COIR ASA FIBRE IN CONCRETE

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ABSTRACT

This paper focuses at the replacement effects on the addition of Fly Ash, Sawdust and Coir in concrete as a partial replacement of Cement and Natural FineAggregates, respectively. Coir, here acts as a fibre in the concrete. The experiment is carried out by finding the slump value, compressive strength, split tensile strength and flexural strength. Natural Fine Aggregates are replaced by Sawdust in 5%, 10%, 15%,20%, 25% and 30% by weight in the concrete. Fly Ash and coir are kept constant at 20% and 4% respectively to the weight of the cement throughout the mix. Fly Ash presents good pozzolonic properties, Sawdust shares similar properties as Natural Fine Aggregates and Coir provides good split-tensile and flexural strengths to the concrete. The results are compared with the control mix of design mix M25. The specimens are tested after 7 days of curing. It is observed that while keeping Fly-Ash and Coir constant at 20% and 4% respectively, up to 20% replacement of Natural Fine Aggregates by Sawdust can be carried out in concrete without decreasing the strength. The value of slump decreases with the increase in the amount of Sawdust. Using these waste products will also benefit the environment as normally such products end up in land-fills and increase the carbon footprints.

Key words: Cement, Fly Ash, Sawdust, Coir and Environment.

INTRODUCTION

Concrete is the most widely used construction material in the world. The demand for it goes Up tremendously day by day. To meets such demands, it requires lots of natural resources to Be exploited which on the other hand pose a great threat to the environment. So this work Aimsat introducing the use of fly ash, sawdust and coir in construction as an addressing Solution to the environmental problems i.e. reduction in the disposal of these by products to The landfills which pose a great threat to the environment and reduction in the emission of Carbon dioxide to atmosphere which cause one of the leading problems of the world today, Global warming. Fly-ash is obtained from combustion of coal and consist of silicon dioxide, Aluminum oxide and calcium oxide. Fly-ash presents good Pozzolonic properties and react Easily with water, so therefore it can be used to partially replace cement in the concrete.Sawdust is the waste product obtained from sawmills, having the size similar to that of Natural Fine Aggregates and also shows a superior adhesion when mixing in concrete, hence It can be used as a partial replacement of Natural Fine Aggregates. Coir being a hard and long Fiber, in nature is used in concrete so as to impart good tensile and flexural properties in Concrete.

2. MATERIALS AND METHODOLOGY

2.1. Materials Used

Ordinary Portland Cement of Grade 43 as per IS 8112(1989), Natural Coarse Aggregates of Maximum size 20mm as per IS 383(1970) and Fine Aggregates

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of Zone 2 as per IS 383(1970), Fly-Ash of class-C, Sawdust collected from local Sawmillsand Coir collected From local vendors were used.

2.2. Research Methodology

Fly Ash was sieved through a sieve size of 90 microns, Sawdust was sieved through a sieve Size of 1.18mm, and Coirwas soaked in water for 2 hours and then slashed to various length And allowed to dry for 24 hours.

In this experiment M25 grade of concrete was used, made with Ordinary Portland Cement(OPC) of Grade 43 with water cement ratio of 0.5,Natural Fine Aggregates, 10 mm And 20mm Coarse Aggregates. Slump test was performed to check the workability of the Concrete and the slump value for control mix was obtained as 85mm.

Here Fly ash and Coir were kept constant at 20% and 4% per weight of cement, Respectively and only Sawdust was varied with respective %ages. The work was carried out in BTen batches: Batch 1 was normal concrete without replacement or the Control Mix, Batch 2 Was concrete with 20% replacement of cement by fly ash, Batch 3 was concrete with 4% coir, Batch 4 was concrete with 20% fly ash replacement and 4% coir to quantity of cement added, Batch 5 concrete with 20% fly ash replacement, 4% coir and 5% sawdust replacement , Batch 6 concrete with 20% fly ash replacement,4% fibres and 10% sawdust, Batch7 concrete with 20% fly ash,4% coir and 15% sawdust, Batch 8 with 20% fly ash,4% coir and 20% sawdust, Batch 9 with 20% fly Ash,4% coir and 25% sawdust, Batch 10 with 20% fly ash, 4% coir and 30% sawdust.

In this work three cubes, three cylinders and three beams were casted for each Batch, Casted for 7days and 28 days of curing. Cubes of standard size 150*150*150 mm dimension Were used, Cylinders of diameter 100 mm and Height

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200mm were used and beams size of 500 mm length, 100 mm breadth and 100mm depth were used. The rate of testing for cubes Was 5.2 KN/sec, cylinders 2.1KN/sec and for beams is 0.1KN/

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Figure 1 Coir

Figure 2 Sawdust

Figure 3 Fly Ash

3. EXPERIMENTAL RESULTS

3.1. Fresh Properties of concrete

3.1.1. Workability

Workability is defined as the ease with which the concrete is placed and compacted homogeneously without showing any bleeding or segregation. Here we checked the workability from slump and it was found to be 85mm.

3.2. Hardened Properties of concrete

Compressive Strength: For 7 daysThe compressive strength tests for 7days result show that upto 15 % replacement by Sawdust, provided 20 %Fly Ash and 4 % coir addition shows good compressive strength than control mix and then it gradually decreases with the increase in the %ages replacement of sawdust, as shown in figures. This is because of the superior adhesive properties of sawdust that provide a better strength to the concrete. Maximum load applied in Newtons at which the cubes failed divided by the cross sectional areas of the cubes in mm2gives the compressive strength of that particular cubes in N/mm2 or MPa. Concrete is good in compression and the following are the average of 7 days result for cubes as shown in

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the Table1 and summarized in Figure 4

Table 1Test result for 7days Compressive Strength of Cubes

MainkuparKharbuki and AshfaqMalik

3.3. Split Tensile Strength: For 7 Days

The split tensile strength tests show that upto 20 % of sawdust replacement provided 20 %Fly Ash and 4%coir shows good split tensile strength than Control Mix and then gradually decreases with increases in percentage replacement of sawdust. Split tensile strength is measured as per IS 5816:1999. Split tensile strength is calculated using the

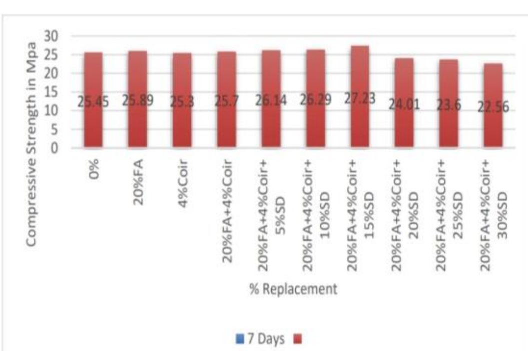

Figure 4 Test results of cubes for 7 days Compressive Strength

formula fct=2p/πld, where p is the maximum load applied to cylinders, π is a constant, l is the height and d is the diameter of the cylinder. Average result of cylinders for 7days are shown in Table2 and summarized in

S.No	Mix	Load (KN)	Compressive strength(N/mm^2)
1	Normal Mix	572.8	25.45
2	Normal mix +20% replacement of Fly Ash(FA)	582.7	25.89
3	Normal Mix+4% coir addition	570	25.3
4	Normal mix+20% Fly Ash(FA)+4% coir	580	25.7
5	20%Fly Ash(FA)+4%coir+5%sawdust(SD)	588.3	26.14
6	20%Fly Ash(FA)+4%coir+10%sawdust(SD)	591.6	26.29
7	20%Fly Ash(FA)+4%coir+15%sawdust(SD)	612.8	27.23
8	20%Fly Ash(FA)+4%coir+20%sawdust(SD)	540.3	24.01
9	20%Fly Ash(FA)+4%coir+25%sawdust(SD)	531.3	23.6
10	20%Fly Ash(FA)+4%coir+30%sawdust(SD)	507.6	22.56

Figure5.

Table 2 7days result split tensile strengt

S.No	Mix	Load (KN)	Split Tensile Strength (N/mm^2)
1	Normal Mix	61.8	1.96
2	Normal mix +20% replacement of Fly Ash(FA)	66.3	2.1
3	Normal Mix+4% coir addition	68.5	2.18
4	Normal mix+20% Fly Ash(FA)+4% coir	68.9	2.19
5	20%Fly Ash(FA)+4%coir+5%sawdust(SD)	69.2	2.2
6	20%Fly Ash(FA)+4%coir+10%sawdust(SD)	71.8	2.28
7	20%Fly Ash(FA)+4%coir+15%sawdust(SD)	72.2	2.29
8	20%Fly Ash(FA)+4%coir+20%sawdust(SD)	73.6	2.34
9	20%Fly Ash(FA)+4%coir+25%sawdust(SD)	60.4	1.92
10	20%Fly Ash(FA)+4%coir+30%sawdust(SD)	58.5	1.86

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Table 3 7days result flexural strength

S.No	Mix	Load (KN)	Split Tensile Strength (N/mm2)
1	Normal Mix	11.1	5.55
2	Normal mix +20% replacement of Fly Ash(FA)	12.7	6.35
3	Normal Mix+4% coir addition	13.2	6.6
4	Normal mix+20% Fly Ash(FA)+4% coir	13.4	6.7
5	20%Fly Ash(FA)+4%coir+5%sawdust(SD)	14.2	7.1
6	20%Fly Ash(FA)+4%coir+10%sawdust(SD)	14.5	7.25
7	20%Fly Ash(FA)+4%coir+15%sawdust(SD)	14.9	7.45
8	20%Fly Ash(FA)+4%coir+20%sawdust(SD)	10.4	5.2
9	20%Fly Ash(FA)+4%coir+25%sawdust(SD)	9.9	4.95
10	20%Fly Ash(FA)+4%coir+30%sawdust(SD)	9.5	4.75

Cement By Fly Ash, Natural Fine Aggregates By Sawdust, and Coir as A Fibre In Concrete

3.4. Flexural Strength: For 7 Days

The flexural strength tests of beams up to 15% replacement sawdust provided 20% Fly Ash, 4%coir show good flexural strength than Control Mix and gradually decreases with increase in the percentage sawdust replacement. This is because of the high fibre content which captured and minimized the splits present in the solids and hence improved the flexural strength of the beams. Flexural strength is measured as per IS 516:1959. Flexural strength is calculated using formula fb=pl/bd2, where p is the maximum load applied to which the beam failed, l is the length of a beam, b is the breadth and d is the depth of a beams. Average result for 7days flexural strength are shown in Table3 and summarized in Figure6.

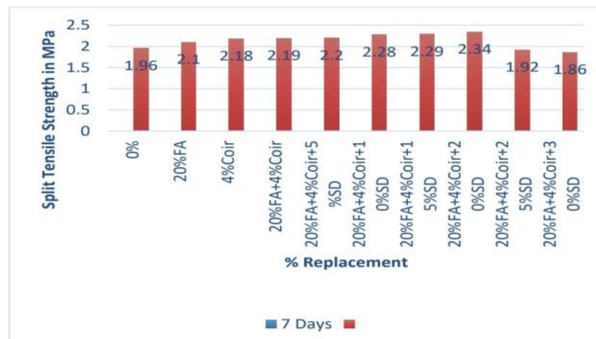

Figure 5 Test result of cylinders for 7days Split Tensile strength

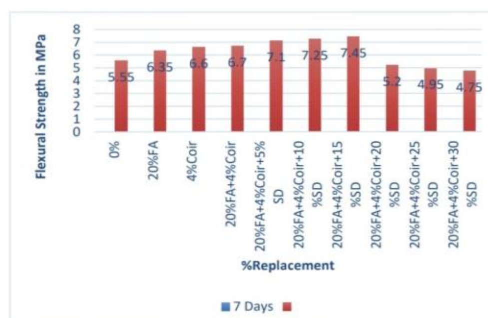

Figure 6 Test result of Beams for 7 Days Flexural strength



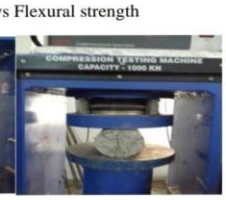

Figure 7 Flexural strength testing **Figure 8** Compressive strength testing **Figure 9** Split tensile strength testing

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4. CONCLUSION

Based on the experimental work it can be concluded that up to 20 % of sawdust can be used in concrete because it provides good strength. For Compressive and flexural strengths upto 15%sawdust shows good results whereas for split tensile strength, up to 20 % sawdust replacement can be made in concrete. The good strength shown by sawdust is due to its superior adhesion which captures and minimizes the splits occurring in the solid and also, the good pozzolonic property of the Fly Ash aids in this mechanism. The concrete also presents better ease of compaction as compared to that of control mix. Furthermore, the introduction of sawdust in the concrete also helps to reduce the improper disposing of the solid waste into landfills and there.

REFERNECES

[1] Jatale A, Tiwari K, Khandelwal S. Effects on compressive strength when cement is partially replaced by fly-ash. IOSR Journal of Mechanical and Civil Engineering. 2013;5(4):34-43p.

[2] Kiran TG, Ratnam MK. Fly ash as a partial replacement of cement in concrete and durability study of fly ash in acidic (H2So4) environment. International Journal of Engineering Research and Development. 2014 Dec;10(12):1Study on Partial Replacement of Cement By Fly Ash, Natural Fine Aggregates By Sawdust, and Coir as A Fibre In Concretehttp://iaeme.com/Home/journal/IJMET 1675 editor@iaeme.com

[3] Pitroda J, Zala LB, Umrigar FS. Experimental Investigations on Partial Replacement of Cement with Fly ash in design mix concrete. International Journal of Advanced Engineering Technology, IJAET. 2012 Oct;3(4):126-9.

[4] Subramani T, Ramesh KS. Experimental Study On Partial Replacement Of Cement With Fly Ash And Complete Replacement Of Sand With M sand. International Journal of Application or Innovation in Engineering & Management (IJAIEM). 2015;4(5):313-22.