Untried Exploration of Finding Optimum Percentage for FSA via Mortar Cubes

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Abstract:
The construction industry relies heavily on cement for its operations in the development of shelter and other infrastructural facilities. Various research workers in the recent past had look into the utilization of agricultural wastes that are known to be pozzolana to partially substitute cement that is the major component of concrete. The use of Ordinary Portland Cement (OPC) and Fins Scales Ash (FSA) will reduce the carbonation attach because it acts as pozzolana materials like fly ash, RHA, Lime powder. The Mix Proportion ratio of 1:3 is made for the mortar cubes while replacing the FSA to cement at different proportion. The Compression test of mortar cubes gives the optimum value for the FSA sample. The variation graphs for 7 days and 28 days gives the peak value as well as the optimum percentage. The optimum percentage obtained in compression test is 10%. The decrease in strength occurs gradually beyond 10%.

Keywords: *FSA, fly ash, Rice Husk Ash, Lime Powder*

I. INTRODUCTION

One of the important scientific challenges in recent decades is finding appropriate measures of controlling the global climate change which is driven by human activities, particularly CO_2 emissions. Ordinary Portland cement (OPC) is responsible for over five percent of CO_2 emissions worldwide. As such, Portland cement is also a common material used in civil engineering fields. However, cement plants emit a large amount of both carbon dioxide (CO2) and toxic fumes into the atmosphere and the manufacturing process of Portland cement requires a high demand of energy, mostly consumed during clinker manufacturing process. And to control this situation now a days many type of replacements for cement is going so far. The replacement is mainly based on the waste material reuse in the supplant for cement (eg:- Fly ash, RHA, CHA, Sea Shell ash, etc.,). It also optimize the carbon di oxide emission. Fish waste was increasing day by day in fish market, it also cause environmental pollution. To make the use of this fish waste (Fins and Scales) it is converted in to ash and it can be replaced to cement as partial supplant. The aim to find the optimum percentage of the replacement to cement is found using the mortar cubes. The mortar cubes gives the optimum percentage of FSA and the optimum percentage of replacement is found.

II. SELECTION OF MATERIALS

A. *Cement*

Ordinary Portland Cement of 53 Grade conforming to IS 8112-1989 [17] with specific gravity 3.15 was used.

B. *Course Aggregate*

Coarse aggregates used were crushed angular aggregates of normal size 20 mm with specific gravity 2.75.

C. *Fine Aggregate*

Fine aggregate used was river sand with specific gravity 2.62, passing through 4.75mm sieve and falling under zone IV as specified in IS 383-1978 [18].

D. *Fins and scales Ash*

FSA was taken from Virudhunagar fish market, Virudhunagar, Tamilnadu, with specific gravity 3.09.

E. *Water:*

Ordinary potable water conforming to IS 456-2000 [16] was used for concreting and curing.

III. EXPERIMENTAL PROGRAM

The main objective of this investigation is to study the behavior of Mortar specimens cast with cement with FSA and fine aggregate. A mix was prepared with 2%,4%,6%,8%,10%,12%,14%,16%,18%,20%. The

mix ID is as given in Table 1. A total of thirty three mortar cubes were cast and tested in this program.

Table 1: Mix proportion for M30 concrete

Mix ID	FSA %
FAS0	0%
FAS02	2%
FAS04	4%
FAS06	6%
FAS08	8%
FAS10	10%
FAS12	12%
FAS14	14%
FAS16	16%
FAS18	18%
FAS20	20%

IV. RESULTS AND DISCUSSION

Compressive Strength variation for Mortar Cubes with varying proportions of Fins and Scale Ash(FSA) is done to find out the optimum value of replacement of FSA to concrete are listed in Table 2.

Table 2: Compressive strength variation

Mix ID	Average Compressive Strength for 7 days (N/mm^2)	Average Compressive Strength for 28 days (N/mm^2)
FSA0	17.5	24.3
FSA02	18.4	25.45
FSA04	19.8	25.9
FSA06	20.5	26.5
FSA08	22.6	27.4
FSA10	23.45	28.3
FSA12	22.25	27.25
FSA14	21.6	26.5
FSA16	20.25	25.6
FSA18	19.25	24.45
FSA20	16.5	23.25

From the Table 2, it is found that the compressive strength increases when the percentage of FSA increases upto 10%, beyond which it reduces. There is an increase in compressive strength of replacing 10% of FSA with the cement. The compressive strength for 12% replacement of FSA is found to be lesser than the control mortar mix.

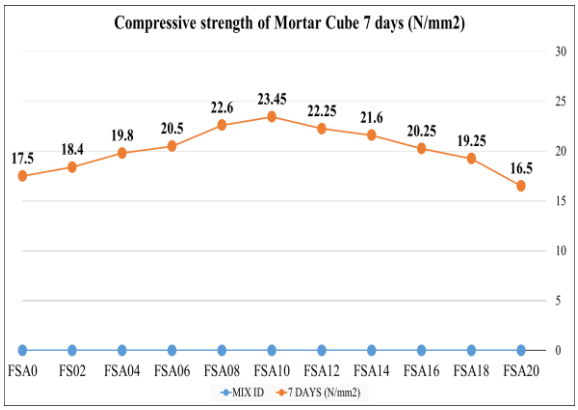

Figure 1: Compressive strength variation for 7 days

Therefore fig.1 shows the increase in compressive strength and the peak value increase shows 34% increase in strength compared to the control mortar mix. The final replacing percentage of FSA20 shows the reduction in compressive strength compared to the control mortar mix.

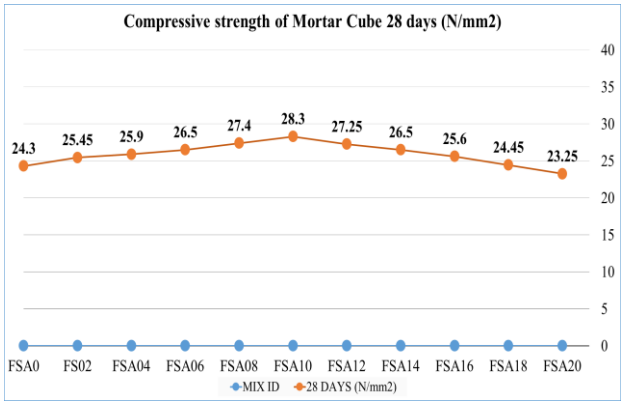

Figure 2: Compressive strength variation for 28 days

Therefore fig.2 shows the increase in compressive strength and the peak value increase shows 16% increase in strength compared to the control mortar mix. The final replacing percentage of FSA20 shows the reduction in compressive strength compared to the control mortar mix.

The variation in strength for 28 days is also done for the same amount of mix proportion 1:3

Therefore table 1 and 2 shows the compressive strength variation in replacement of FSA with cement and the optimum percentage for FSA is found by the peak values obtain from those graphical representations, peak value occur in 10% replacement of FSA. It is due the presence of HA and CaCo3 in Fins Scale Ash.

V. CONCLUSION

The optimum percentage of FSA is found through the compressive strength test in mortar cube, the values of the compression test was graphically represented to show the peak value obtained. The

strength is achieved while replacing 10% of FSA with cement. The further adding of FSA gives the gradual decrease in strength and the strength of 20% replacement of FSA comes partially equal to the compression value obtained in control mortar mix.

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