Utilization of Agricultural and Commercial Waste Material in Construction

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Abstract— Various materials with pozzolanic properties like fly ash, Condensed silica fume, blast furnace slag and rice husk ash have played an important part in the production of high performance concrete. During the late 20th century, there has been an increase in the consumption of mineral admixture by the cement and concrete industries. The increasing demand for cement and concrete is met by the partial replacement of cement by supplementary materials in concrete. Several pozzolanic materials have demonstrated their effectiveness in producing high performance concrete. This research deals utilization of the agricultural and commercial waste material into concrete, which may enhance the characteristics of concrete and makes environment eco-friendly. In the present work Rice husk ash (RA) has been used as partial replacement of cement in 10, 15, 20, 30%, and sand is also replaced by shredded steel waste in different proportions such as 10%, 15%, 20% and 30% and in third mix both the ingredients have been replaced simultaneously. Properties tested are compressive strength after 3, 7, 14 and 28 days and workability by measuring slump cone in 1:1:2 proportions. It has been observed that with the increase in percentage of RA compressive strength increases up to 20% and then decreases. However, with the increase in percentage of steel waste compressive strength keeps on increasing.

Keywords: Rice Husk Ash, Compressive Strength Test, Slump Cone Test, Standard Consistency Test, Aggregate Impact Test

I. INTRODUCTION

Use of recycled or waste materials for the construction of civil structures is a matter of great significance in this century. Use of waste materials in construction industry reduces the utilization of Portland cement per unit volume of concrete. OPC has large energy emanation related with its production, which may be declined by substituting cement partly with waste products. Mixing of mineral admixtures in concrete and mortar enhances compressive strength, pore structure and permeability. Some materials known as Pozzolana, which have no cementitious properties, but when added with OPC reacts to form cementitious materials.

Fractional substitution of Pozzolana in concrete decreases the amount of Portland cement. This reduction in cement quantity further decreases the construction cost, energy loss and waste emissions such as carbon dioxide (CO2) emission. This also, decreases the energy consumption and thus, reduces the rate of global warming.

II. METHODOLOGY

The methodology used based on basic properties, and test of concrete ingredients and according to IS Code mix design method.

Following test are conducted on materials in this study -

A. Compressive Strength Test:

Cement and sand in cement concrete has been replaced in 10, 15, 20, 30% with silica fume and steel powder respectively, and in third mix both the ingredients have been replaced simultaneously. Their compressive strength has been tested after different curing periods such as 3 days, 21days and 28 days standard curing conditions. 0% replacement represents the original OPC concrete mix concrete prepared by OPC concrete with concrete formed by replacing cement with steel powder for concrete mix M1.

B. Setting Time:

Along with compressive strength and workability of concrete, setting time of cement is major parameter required for testing the quality of concrete mix, again by mixing marble powder in cement mortar in different proportions such as in 10, 20 and 30% and testing setting time by Vicat's apparatus following results were obtained and from results it has been observed that setting time delays by mixing the marble powder.

C. Slump Cone Test:

Along with compressive strength workability of concrete is major parameter required for testing the quality of concrete mix, again by mixing marble powder in cement concrete in different proportions such as in 10, 15, 20, 30% and performing slump cone test following results were obtained.

III. RESULT

1) Maximum compressive strength is found at 20% replacement of cement with Rice husk Ash after 3, 7 and 28 days of curing.
2) Maximum compressive strength is found at 30% replacement of sand with Shredded steel waste after 3, 7 and 28 days of curing.
3) Maximum compressive strength is found at 3% replacement of both cement and sand after 3, 7 and 28 days of curing.
4) Compressive strength of concrete mix increases with high percentage when sand is replaced with Shredded steel waste.
5) Compressive strength of concrete mix was increased slowly when both the chief ingredients were replaced altogether.

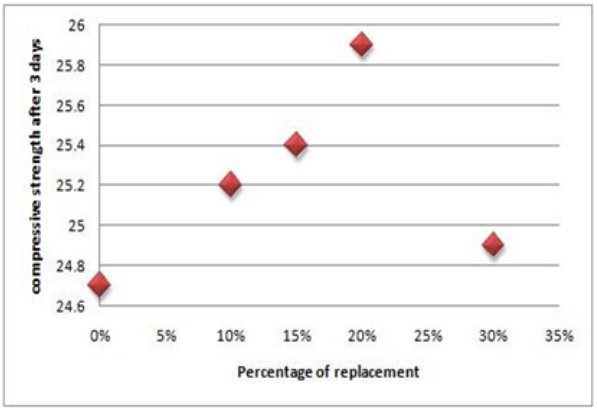

Fig. 1: 28 days compressive strength for M1

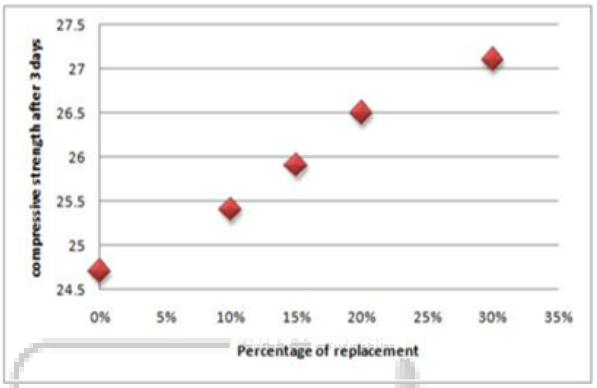

Fig. 2: 28 days compressive strength for M2

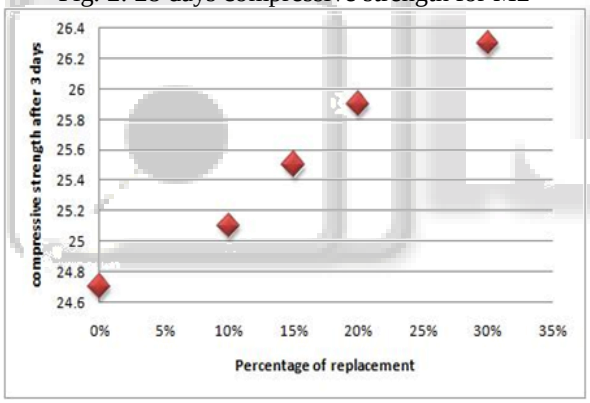

Fig. 3: 28 days compressive strength for M3

IV. CONCLUSION

Following are the conclusions of the present work –

1) By replacing cement with RA in M1 mix compressive strength increases up-to 205 and then decreases with increase in percentage replacement of cement.
2) Compressive strength has been found to be highest at 20% replacement of cement by RA in M1 mixes.
3) Slump value is found to be decreasing by increasing the percentage of RA.
4) Compressive strength increases and Slump value decreases by increasing the percentage of replacement of sand by SSW in M2 mixes.
5) Hence, from above results it has been recommended to replace cement about 20% with RA for higher compressive strength and optimum workability.
6) Results indicate that compressive strength increases with the combined use of SSW and RA in concrete.
7) Slump value is higher in case of M3 concrete mix when compared with M1 and M2 mixes. However, with the increase in percentage of replacement value of slump cone decreases in all the three concrete mixes M1, M2 and M3.

V. FUTURE SCOPE OF THE WORK

The presence of Agriculture waste is considered in the thesis opens a future scope of work for the followings:

1) The present research has been carried out only for the M20 grade of concrete mix having Agriculture waste.
2) The scope of research could be further extended and research needs to be carried out on different percentages and grades of concrete also.

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