



Study on Workability And Strength Of M35 Grade Self Compacting Concrete By Using Plastic Waste And Alccofine Materials

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Abstract- Self compacting concrete is defined as concrete that has ability to flow under its own weight. Compaction process of self compacting process is done without any external vibrations. Generally strength values for SCC is higher than normal concrete mix due to its mix proportions. The concrete material is made with composition of materials like cement, sand, coarse aggregates and water. Strength and workability are the important properties of the concrete before construction any structure, basically strength of the concrete member depends upon the amount of the load which comes to the concrete member. As the world moves forward with technological advancements, it has seen a paradigm shift towards more sustainable growth. Many studies even promote zero wastage by recycling and reusing most of the by-products. Now a waste plastic is increasing due to increasing the population in the world that will affect the environmental parameters which pollutes the earth, air and water if that happens the total earth will be polluted. To decrease this effect reducing the generation of waste materials is important but in practical it is not possible to decrease the waste materials with this current population of the world. Alccofine is a new generation material that will increase the strength of self compacting concrete. Alccofine is finer material than hydraulic materials like cement, fly ash etc, the alccofine is developed in control conditions with specified equipments to get make finer particles.

In the present paper an experimental investigation was conducted to study the workability and strength properties of concrete by using plastic waste and alccofine as replacement materials for Fine aggregate and cement respectively. The percentage of plastic waste used as 0%, 2.5%, 5%, 7.5% and 10% of Fine Aggregate and alccofine used is 5% for all mixes for M35 grade of concrete mix. The comparison of results like workability and strength was made with and without using alccofine.

Key words: Self compacting concrete, alccofine, plastic waste, workability, strength.

I. INTRODUCTION

Self compacting concrete is the one in which the concrete flows under its own weight. There is no need of vibrations to get compaction of concrete. Day by day the concept of self compacting concrete is increasing to get high strength than the normal concrete mixes. In general the strength of SCC is higher than normal grade of concrete mixture due to its mix proportion. Plastic waste is the finest material which is collected from various locations. It contains the things that we use daily for human activities like plastic bottles, packing apparatus and appliances related to plastic materials. That will be generated from our houses, hospitals, industries, and schools etc. Day by day the generation of above specified materials is increasing due to increase of population in the world that will affect the environmental parameters which pollutes the earth, air and water. To decrease this effect reduction of waste materials is important but in practical it is not possible to decrease the waste materials with this current population of the world. For that reason many engineers conducted various studies to decrease the solid waste which is developed with various human activities in various industries by using them in construction projects. As per the civil engineering point of view strength is important property to be considered for designing any structure on the earth.

The concrete is the material used for construction of building or structure generally. The mainly used constituents like cement, fine aggregates, coarse aggregates, water and admixture (if any) for making the concrete mix with respect to the specified grade of concrete. The major material is the cement that helps to bind the remaining (fine aggregates, coarse aggregates, water and admixture) materials but the

production of large scale of cement is also effects the environment by releasing the CO₂ in manufacturing process, for that case reduce the cement material production to save the environment, the engineers have studied various fine materials usage instead of cement content like fly ash, GGBS, metakolin etc. by using the Alccofine material there is a chance for decrease the production of cement in this word. But we have to use certain amount of the content to get the strength. In this current research the plastic waste and alccofine which is collected from various areas and the percentage used in the various mix trails are 0%, 2.5%, 5%, 7.5% and 10%, alccofine used as 5% in M35 grade concrete mix to determine the workability properties and strength characteristics.

II. MATERIALS USED FOR THE RESEARCH

For this present experimental study the materials like cement, fine aggregates, coarse aggregates, waste plastic and alccofine materials were used.

Cement

Cement is a binding material used in the construction. It is important to select good quality of cement to get maximum strength. For the present study OPC 53 Grade cement was taken which is shown in below figure 1.



Figure 1: OPC 53 Grade ACC Cement used for the present study

Coarse aggregate

Coarse aggregates are the materials which are retained on IS 4.75mm sieve. In the current study coarse aggregates which are collected from local areas of Hyderabad. The below figure 2 shows the coarse aggregates sample with is used in this study. The coarse aggregates which are passing through 12.5mm sieve and retained on 10mm IS sieve are used to make self compacting concrete mixture.



Figure 2: Coarse aggregates

Fine aggregates

Fine aggregates are the materials which are passing through 4.75mm sieve. The fine aggregates used in this present study is shown in below figure 3. The fine aggregates (Sand) has particles size less than 1.18mm was used in this current study to make self compacting concrete mixture as per mix design of M35 grade concrete.



Figure 3: Fine aggregates

Waste plastic

The waste plastic is the material which contains things that we use in our daily life like plastic bottles, packaging, appliances which comes from our homes, schools, hospitals, and businesses. After collecting plastic materials crush them in crushing machine to get finer particles which are shown in the below figure 4. The crushed material is again sieved in IS 1.18 mm sieve to get particle sizes approximately equal to that of the fine aggregates sizes.

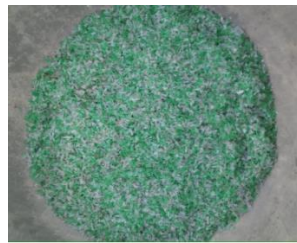


Figure 4: Plastic waste used in this current study

Alccofine

Alccofine is a new generation fine material having particle size much less than cementitious material like cement, fly ash, silica fume etc, It is manufactured in the controlled conditions with special equipments to produce optimized particle size distribution which is its unique property. The below figure 5 shows the alccofine material which is used in the present study



Figure 5: Alccofine

Super plasticizer

Now a day's most of the people are using super plasticizer to increase the strength of the concrete. In the present study Betan Polymix PCE 3000 admixture was taken which is 1% of cement content as per the mix design of the self compacting concrete (SCC) is concern.



Figure 6: Super plasticizer used in this research

Mix proportion

In the present study M35 grade mix design is carried out to check the strength of concrete. The following mix proportion shows the mix design of M35 grade concrete which is calculated as per the preliminary investigation of materials and by using IS: 10262:2009 code book.

Water	Cement	Fine aggregate	Coarse aggregate
0.40	1	1.57	1.44

III. EXPERIMENTAL INVESTIGATION

Casting of the specimens

Casting of cubes, cylinders and rectangular prisms were done for M35 grade concrete, the mix proportions used are normal concrete, with the partial replacement of fine aggregate with 0%, 2.5%, 5%, 7.5% and 10% of plastic and cement with 5% alccofine powder.

Curing the test specimens

After casting the specimens leave those to room temperature for 24 hours at least after hardening process de mould the test samples carefully without any damage for the various trials of municipal solid waste replacement. Now submerge the demoulded specimens in curing tank generally for 7 days, 14 days, 28 days age for strength calculations.

Compressive strength of concrete

Compressive strength of concrete is determined for cube specimens having size of 100mm x 100mm x 100mm. This test is carried out by using Compression Testing Machine (CTM) having its capacity of 200T. For the current study the compressive strength is determined with different percentages of plastic waste from 0% to 10% with and without using 5% Alccofine powder for M35 grade concrete with the help of IS 516-1959 code Book .



Figure 7: Compression Testing Machine (CTM)

Split tensile strength

The split tensile strength is determined for cylindrical specimen having radius of 150mm and height of 30mm. This test is carried out according to IS 516-1959 code by using compression testing machine (CTM) having its capacity of 200T. This test is also determined by using different percentages of plastic waste from 0% to 10% with and without 5% Alccofine powder.

Flexural strength

The flexural strength of the concrete is determined for prism specimens of size 150mm x 150mm x 700mm are used. The flexural strength is determined for various percentages of MSW from 0% to 20% by using IS516-1959.



Figure 8: Flexural strength testing machine

IV. RESULTS AND ANALYSIS

Workability of concrete

Comparison of Slump flow

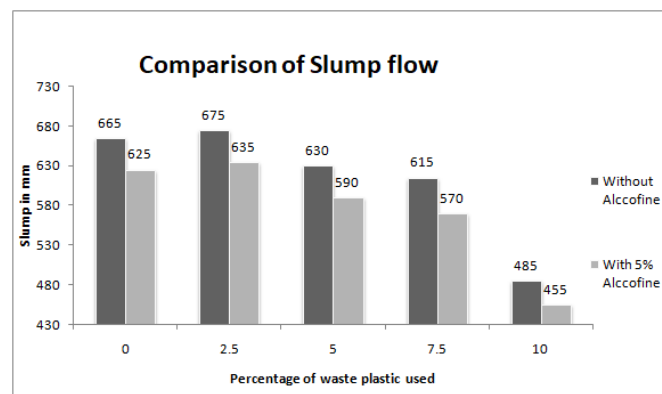


Figure 9: Comparison of slump flow test results with and without using alccofine

Comparison of T50 Test

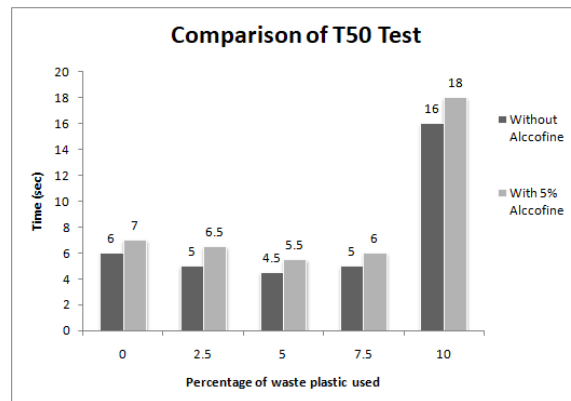


Figure 10: Comparison of T50 test results with and without using alccofine

Comparison of J Ring Test

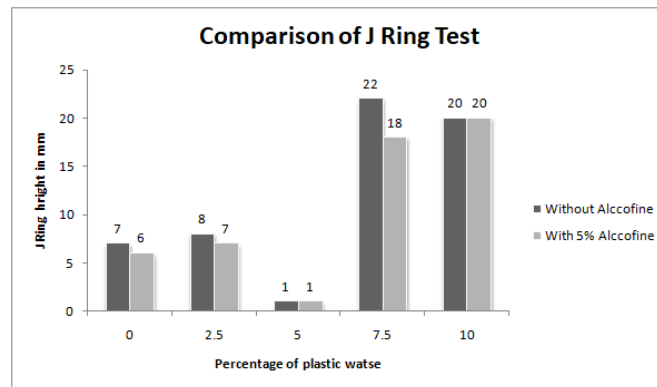


Figure 11: Comparison of J Ring test results with and without using alccofine

Comparison of V Funnel flow

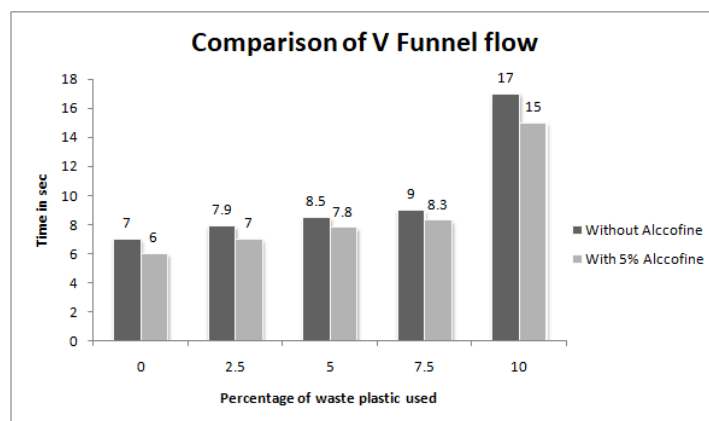


Figure 12: Comparison of V Funnel flow test results with and without using alccofine

Comparison of L Box Height Ratio

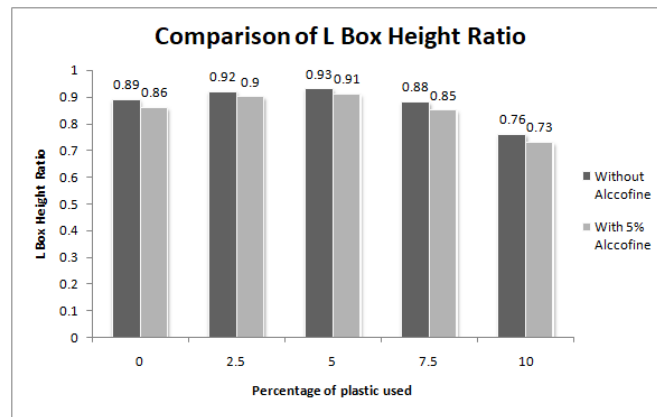


Figure 13: Comparison of L Box Height Ratio test results with and without using alccofine

*Strength of concrete
Compressive strength
7 days*

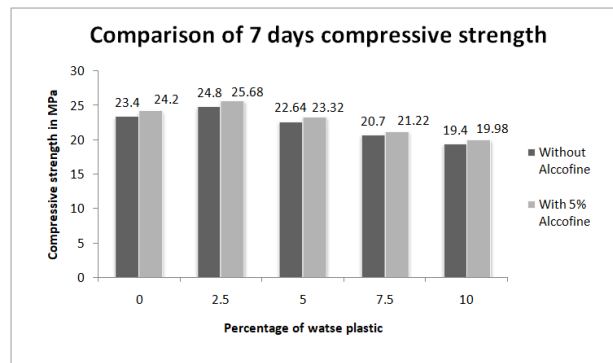


Figure 14: Comparison of 7 days compressive strength results with and without using alccofine

14 days

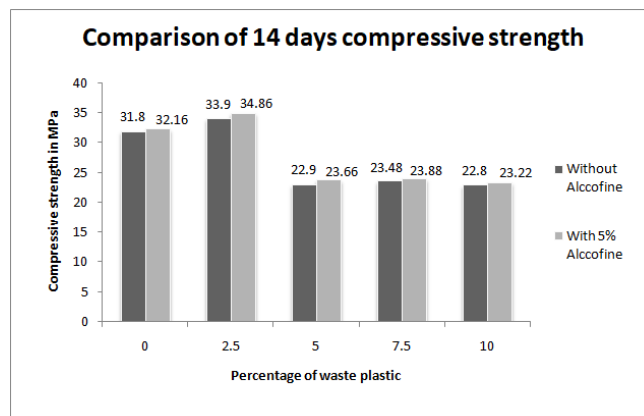


Figure 15: Comparison of 14 days compressive strength results with and without using alccofine

28 days

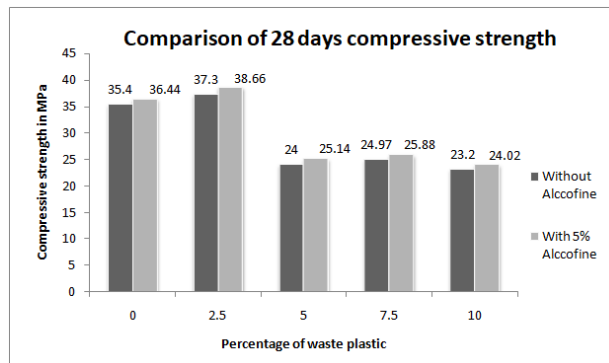


Figure 16: Comparison of 28 days compressive strength results with and without using alccofine

Split tensile strength

7 Days

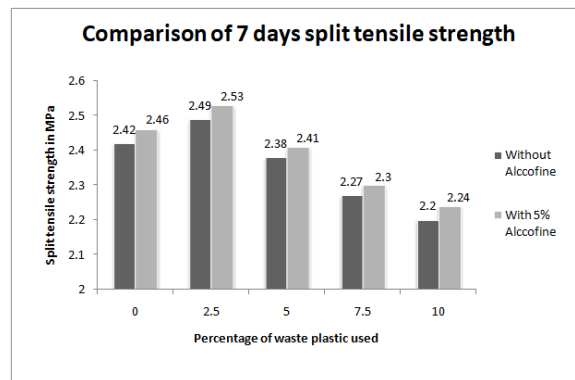


Figure 17: Comparison of 7 days split tensile strength results with and without using alccofine

14 Days

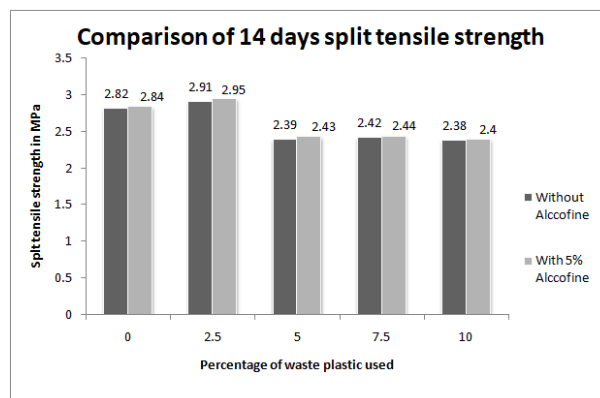


Figure 18: Comparison of 14 days split tensile strength results with and without using alccofine

28 Days

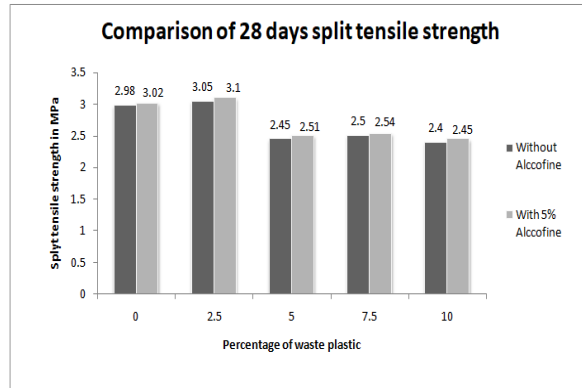


Figure 19: Comparison of 28 days split tensile strength results with and without using alccofine

Flexural strength of concrete

7 Days

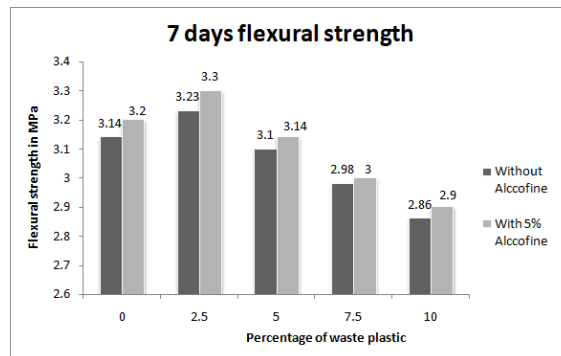


Figure 20: Comparison of 7 days flexural strength results with and without using alccofine

14 Day

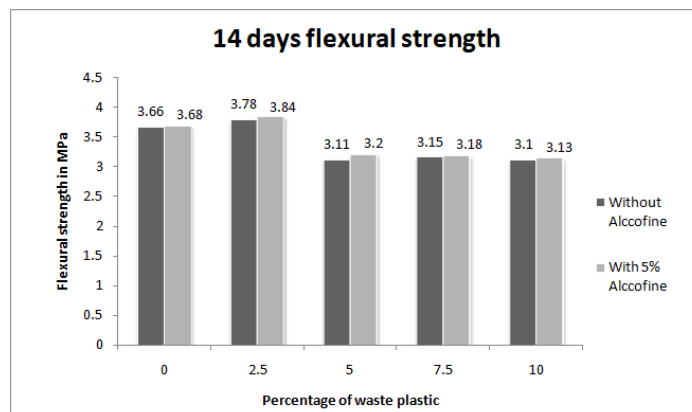


Figure 21: Comparison of 14 days flexural strength results with and without using alccofine

28 Days

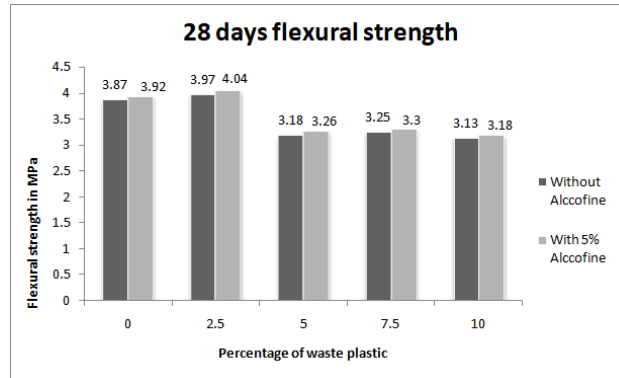


Figure 22: Comparison of 28 days flexural strength results with and without using alccofine

V. CONCLUSIONS

Eco friendly, Green Concrete has been promoted worldwide to encourage Sustainable Development in the field of Construction where huge amount of concreting works are carried out. Utilizing plastic Waste as a partial replacement for fine aggregates provides a significant role in its disposal due to its adversarial effects. When investigated for partial replacement the following highlights were noted:

1. Slump value is decreasing by increasing the percentage of plastic waste from 0% to 10% ,the slump value is also increasing by adding alccofine.
2. The T50 test value increases by using alccofine case, J Ring value , V funnel and L box test value has higher value for without alccofine case
3. The optimum value of compressive strength at 7 days, 14 days and 28 days is obtained at 2.5% plastic waste case. If we add alccofine in concrete we can increase the compressive strength values
4. The optimum value of split tensile strength at 7 days, 14 days and 28 days is obtained at 2.5% plastic waste case.
5. The optimum value of flexural strength at 7 days, 14 days and 28 days is obtained at 2.5% plastic waste case.

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