Experimental Study of Concrete With Partial Replacement of Sand By Waste Glass Powder And Used Engine Oil

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Abstract- *Construction industry is in need of some alternate materials due to the depletion of resources. Our study is the attempt to use waste glass powder as partial replacement of fine aggregate which gives more strength with the addition of used engine oil. In this study waste glass powder replaces the fine aggregate by 5%,10% and 15% by the weight of fine aggregate in M20 grade. Used engine oil is added at a dosage of 0.3% by cement mass. Mechanical properties of concrete are tested at 28 days of curing. The results are compared with the results of conventional concrete.*

Keywords- Glass powder, Used engine oil, Mechanical properties, Conventional concrete

I. INTRODUCTION

Concrete is a composite material composed of coarse granular material embedded in a hard matrix of material that fills the space between the aggregate particles and glues them together. In its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of Portland cement and water, coats the surface of the fine and coarse aggregates. Through a chemical reaction called hydration, the paste hardens and gains strength to form the rock-like mass known as concrete. Concrete is the world's most important construction material. The quality and performance of concrete plays a key role for most of the infrastructures including commercial, industrial, residential and military structures, dams, power plants and transportation systems. Meanwhile the conservation concepts of natural resources are worth remembering and it is very essential to have a look at the different alternatives. Glass powder (GP) used in concrete making leads to greener environment. In shops, nearby Chidambaram many sheet glass cuttings go to waste, which are not recycled at present and usually delivered to landfills for disposal. Using GP in concrete is an interesting possibility for economy on waste disposal sites and conservation of natural re- sources. Recycled waste glasses were used as sand replacement in concrete at various ratios. Diverse concrete properties were tested in fresh and hardened states. The incorporation of glass sand showed no significant influence on fresh or mechanical properties of concrete. Drying shrinkage was reduced due to the negligible water absorption of glass sand, especially at lower water-cement ratios (wc). Resistance to chloride ion penetration was substantially enhanced because of the improved and densified microstructure at the interface transition zone (ITZ). Cement is a fine, grey powder. It is mixed with water and materials such as sand, gravel, and crushed stone to make concrete. The cement and water form a paste that binds the other materials together as the concrete hardens. The ordinary cement contains two basic ingredients namely argillaceous and calcareous. In argillaceous materials clay predominates and in calcareous materials calcium carbonate predominates. The Basic composition of cement is provided in table. In the present work 53 grade was used for casting cubes and cylinders for concrete mixes. The cement was uniform colour i.e. grey with a light greenish shade and was free from any hard lumps. Sieve Analysis of the Fine Aggregate was carried out in the laboratory as per IS 383-1970. The sand was first sieved through 4.75mm sieve to remove any particle greater than 4.75 mm sieve. According to IS 383:1970 the fine aggregate is being classified in to four different zone, that is Zone-I, Zone-II, Zone-III, Zone-IV. It is an industrial by product. It is a by-product of stone crushing which broken downs into fine aggregates. It is grey in colour and is like fine aggregate. Converting stones into useful by-product quarry dust has many benefits like maintenance of ecological balance. Also it is used for different activities in construction industry such as road construction and manufacture of building materials such as light weight aggregates bricks and tiles. Sieve Analysis of the Fine Aggregate was carried out in the laboratory as per IS 383-1970. It is sieved through 4.75mm IS sieve.

II. OBJECTIVES

- The main objective of our project is to partially replace glass powder and develop the strength of concrete by using used engine oil as admixture.
- The specimens are tested to evaluate their mechanical properties.

- The results are then compared with that of the conventional concrete.

III. MATERIALS USED

A. Cement

Ordinary portland cement (OPC) is the basic Portland cement and is best suited for use in general concrete construction. In this study OPC 53 grade cement is used. One of the important benefit is the faster rate of development of strength.

Table 1: Test results of cement

S.no	Description	Obtained value
1	Specific gravity	3.15
2	Fineness	4.67%
3	Standard consistency	32%
4	Initial setting time	30
5	Soundness	Sound

B. Aggregates

Aggregate properties greatly influence the behavior of concrete, since they occupy about 80% of the total volume of concrete. Fine aggregates used throughout the work comprised of clean river sand with maximum size of 4.75mm conforming to zone II as per IS383-1970 [9] with specific gravity of 2.6. Quarry dust can be defined as the residue tailing or other non-voluble waste material after the extraction and processing of rocks to form fine particles less than 4.75mm is used. Coarse aggregates used consisted of machine crushed stone angular in shape passing through 16mm IS sieve and retained on 4.75mm IS sieve.

Table 2: Test results of coarse aggregate

S.no	Description	River sand	Quarry dust	Coarse aggregate
1	Fineness modulus	3.19%	3.19%	2.77
2	Specific gravity	2.57	2.61	4.82
3	Aggregate impact test	-	-	39%
4	Water absorption	-	-	0.41%

C.Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Thus the quantity and quality of water added to be noted carefully.

D. Glass powder

Glass powder is obtained by crushing the beverage bottles. The glass powder is used as partial replacement of fine aggregate. The size of particles used is 90microns. The specific gravity of the glass powder was found to be 2.5.

E. Used engine oil

Waste engine oil was used as admixture in the concrete production. Used liquid form of waste engine oil is available in market and it was used as admixture. Waste engine oil was added into concrete composition with a dosage 0.3% by weight of cement.

IV. EXPERIMENTAL INVESTIGATION

A. Casting of specimen

The specimens are casted as cubes, cylinders and prisms with M20 grade concrete. The cubes are of dimension 150x150x150 mm. The cylinders are of diameter 100 mm and height 300 mm. The prisms were of cross section 100x100 mm and length of 500 mm.

Table 3: Number of specimens

Specimen	Conventional	5%	10%	15%
Cube	3	3	3	3
Cylinder	3	3	3	3
Prism	3	3	3	3

B.Curing

After 24 hours of casting the moulds are removed and specimens are kept for curing. Curing is done by immersing the specimens in clean water for 28 days.

C.Testing of specimens

1.Compressive strength test

Compressive strength test is done by placing the cube in the compression strength testing machine and load was applied. The ultimate load at which the specimen fails is noted. The compressive strength is calculated and is given in table 4.

Table 4: Compressive strength test

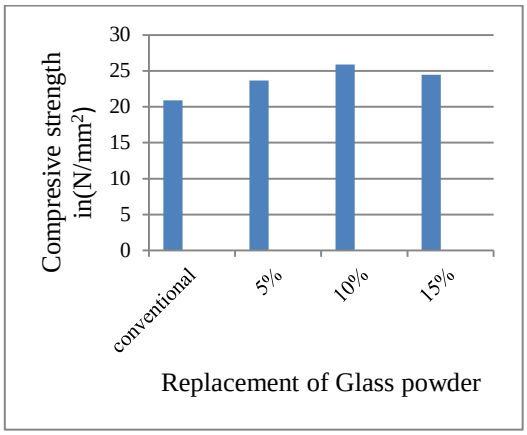

Figure 1: Compressive strength test graph

2.Split tensile strength test

Split tensile strength test is done by placing the cube in the compression strength testing machine and load was applied. The ultimate load at which the specimen fails is noted. The split tensile strength is calculated and is given in table 5.

Table 5: Split tensile strength test

Replacement of Glass Powder	Average strength (N/mm2)
Conventional	20.9
5 %	23.67
10 %	25.89
15 %	24.45

Replacement of glass powder	Average strength(N/mm2)
Conventional	2.56
5 %	2.53
10 %	2.92
15 %	2.72

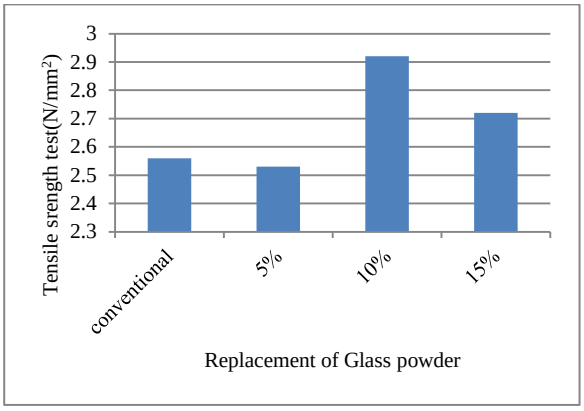

Figure 2: Tensile strength test graph

3.Flexural strength test

Flexural strength test is done by placing the cube in the flexural strength testing machine and load was applied. The ultimate load at which the specimen fails is noted. The flexural strength is calculated and is given in table 6.

Table 6: Flexural strength test

Replacement of glass powder	Average strength(N/mm2)
conventional	1.48
5 %	0.60
10 %	1.54
15 %	0.47

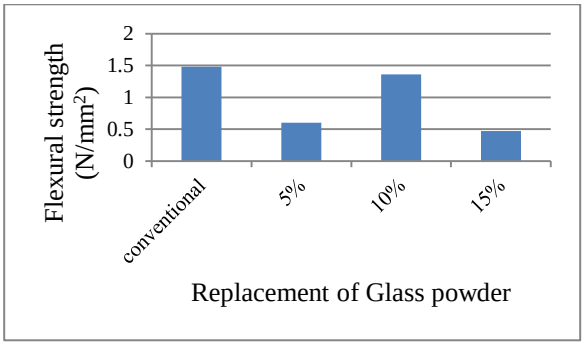

Figure 3: Flexural strength test graph

V. CONCLUSION

Based on the results of this study, the following conclusions can be drawn:

- There is an increase of 34% in the 28th day cube compressive strength of 10% glass powder replaced concrete when compared to Conventional concrete.
- In split tensile strength there is an increase of about 3.8% in 28 days of 10% glass powder replaced concrete when compared to conventional concrete.

- There is an increase of 12.32 % in the 28th day flexural strength of 10% glass powder replaced concrete when compared to conventional concrete.

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