

Study on Cement Concrete Using Glass Powder

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ABSTRACT

Cement industries emits carbon di – oxide which contributes 65% of global warming. Around 7% of greenhouse gas emission happens through global cement industries. In order to avoid such environmental effects the alternative binders should be developed to prepare concrete. Main objective of the study is replacing the cement with finely crushed glass powder of size 75 microns of 10%, 20% and 30%. This concrete is tested for compressive, tension and flexural strength and same is compared with conventional concrete of 100% cement content. From the test the glass powder concrete gives more strength as compared to conventional concrete and can be used for normal construction process.

KEY WORDS: Cement Concrete, Glass Powder, construction.

1. INTRODUCTION

In sustainable construction importance of waste materials usage in concrete is increasing in manner. The waste glass from small shops is disposing it as a landfill waste. Without changing its chemical property the glass can be used so many times. This waste glass is used for water filtration, grit plastering, sand cover for sport turf and sand replacement in concrete.

The use of river sand as fine aggregate tends to exploitation of natural resources which cause lowering of water table. In cement manufacturing a replacing aggregate with glass waste will reduce unit weight of the concrete, under laboratory studies glass has high silica content on its feasibility condition. The use of fine glass powder as a cement replacement material is giving good results. Optimal range of this glass powder is selected depends upon cement paste studies.

The ultimate aim of this work is to study the conventional concrete mixture and compared with modified concrete using glass powder as a aggregate.

2. EXPERIMENTAL INVESTIGATION

The waste glass is crushed and sieved to get a particle size of 75µm. replacement of 10%, 20% and 30% is used to replace the cement content and finally the design of concrete proportion is prepared

A. Materials used

- Cement & aggregates: OPC grade 43 is used as per IS 8112. Rivwer sand is used as fine aggregate (grade zone II). As per IS: 383 the coarse aggregate was selected and used.
- Glass powder: Locally available Waste glass has been collected and crushed for powder. This study size 75 µm of glass powder is used as replacement material. This is shown in figure 1.



Figure.1. Glass powder of 150

Table.1. properties of glass Powder

S.No	Physical Properties	
1	Specific gravity	2.6
2	Fineness	93

Table.2. Properties of glass powder

S.No	Properties of Glass Powder	
1	pH value	10.2
2	Color of the glass powder	Grey - White

Table.3. Chemical Composition

S.No	Chemical Properties	Percentage %
1	Silicon Di oxide	67

2	Aluminum Oxide	2.62
3	Ferric Oxide	1.42
4	Titanium Di Oxide	0.157
5	Calcium Oxide	13.45
6	Magnesium Oxide	2.664
7	Sodium Oxide	10.05
8	Potassium Oxide	0.927
9	Zirconium Oxide	0.020
10	Strontium Oxide	0.016
11	Phosphorous Pent oxide	0.041
12	Nickel Oxide	0.014

Concrete mix design based on IS codes:

- Design Mix: M20 mix was prepared based on IS 10262 – 2009. Based on the calculation the cement content was found to be 380 kg/m³, water cement ratio is 0.40. Design proportions are 1:2.5:3.2. 10, 20 and 30 percent of glass powder are replaced with cement. Any type of admixtures is not used in this study.
- Durability Test: the concrete prepared is cured under normal for 28 days. The specimens were tested at 28 days for determining the compressive, tensile and flexural strength.
- Workability Test: Workability is the property of freshly mixed concrete is defined as how easily placed and compacted. As per IS code 1199 the workability of the concrete is determined by slump test, and the slump value is maintained at 65 mm.
- Alkalinity test: After 28 days the. Specimens are dried and grinded in the size of 150 microns, and about 10 gm are taken and diluted by 50 ml of distilled water. pH value of the stirred solution is found using pH meter and the results are shown in fig 4

Table.4. pH value of glass powder replaced concrete

% Replacement	pH
0	10.65
10	11.72
15	13.47
20	13.56
25	12.90

3. RESULT AND DISCUSSION

As per IS: 516-1959, the compressive strength is attained by standard compression testing machine of 3000kN capacity.

Totally 40 specimens of size 10cmX 10cm X10cm, and 35 cylinder specimens are prepared and compressive strength test conducted after 28 days. At 28 days the glass powder concrete shows strength of 41.96N/mm², strength at 30% cement replacement, at 28 days. The flexural strength of glass powder added concrete at the age of 28 days. At 28 days, in 10% replacement the strength has been increased to 6.5N/mm². The pH Value found is within the limits (more Alkaline) hence it gives more resistant to corrosion.

4. CONCLUSION

After testing glass powder concrete gives more strength compared to normal concrete. And test results are given below.

Compressive test results:

Replacement Percentage	Compressive strength N/mm ²
10	18
20	24
30	31

Flexural Strength Results:

Replacement Percentage	Flexural strength N/mm ²
10	82
20	96
30	99

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