



Experimental Investigations on Effect of Partial Replacement of Cement with Waste Glass Powder in a Concrete Mix

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ABSTRACT:- This study was conducted to investigate the effect of using waste glass powder as a partial replacement of cement in concrete. Laboratory work was conducted to determine the performance of control sample and concrete with used waste glass powder. The performance of these types of concrete was determined by the Workability Test and Compressive Strength test. The workability of concrete was determined using Slump Test. Meanwhile, Compressive Strength Test is done to determine the strength of concrete. For each type of concrete, a total of six cubes were cast. The cubes were tested at the ages of 3, 7, 28 days to study the development of Compressive strength. Glass powder was partially replaced as 7.5%,15%,22.5% and tested for its compressive strength and workability up to 3,7 and 28 days of age and compared with those of conventional concrete.

KEYWORDS- Waste glass powder, Compressive Strength, Workability, Slump Test.

I.INTRODUCTION

Concrete is the most widely used man made material used in construction industry and is the second after water as the most utilized thing on the Earth. It is nearly impossible to think of construction industry without concrete. In simple words it is defined as a mixture of four ingredients as coarse aggregates that form the largest proportion of the mix, fine aggregates such as sand that act as filler material in the voids, binding material such as lime or Portland cement that binds these material together and water that reacts with binding material, This reaction is called as hydration of concrete.

The concrete can be classified on the basis of its characteristic compressive strength .on basis of compressive strength concrete have been classified as

Table 1.1: Classification of concrete

Classification	Compressive strength of concrete
Low strength concrete	Less than 20 MPa
Moderate strength concrete	20-50 MPa
Low strength concrete	50-200 MPa
Ultra-high strength concrete	More than 200 MPa

Based on its compressive strength, the concrete can be graded as M10, M15, M20 and so on, where M is denomination for mix and 10, 15, 20 are the characteristic compressive strength of concrete after 28 days.

One of the most important component of concrete is Cement, used as a binding material it plays the most important role in formation of concrete but, Cement manufacturing industry is one of the carbon dioxide emitting sources besides deforestation and burning of fossil fuels. The global warming is caused by the emission of greenhouse gases such as carbon dioxide, to the atmosphere. Among the greenhouse gases carbon dioxide contributes about 65% of the global warming. The global cement industry contributes about 7% of greenhouse gas emission to the earth's atmosphere. In order to address environmental effects associated with cement manufacturing, there is a need to develop alternative binders to make concrete.

Therefore in this research, considering the environmental ill effects of manufacturing of cement a waste product produced after the use of glass i.e. post-consumer waste glass, is used as a partial replacement of cement in concrete in different percentage here effort is to recover and use waste glass or otherwise its end up at disposal landfill

A. Advantages of using Waste Glass Powder

- 1.) Most soils contain some sulphate in the form of calcium, sodium, potassium and magnesium. They occur in soil or ground water. Because of solubility of calcium sulphate is low, ground water contains more of other sulphates and less of calcium sulphate. If we use glass powder it provides resistance to sulphate attack on concrete.
- 2.) Replacement of cement by glass powder give reduction in environment pollution because in making of cement it required to burn and grind the different type of material which produces various toxic gases.
- 3.) In glasses recycling process first glass are collected then they are sorted.
- 4.) The waste glasses which can't be used and is send to landfill, can be used in concrete.

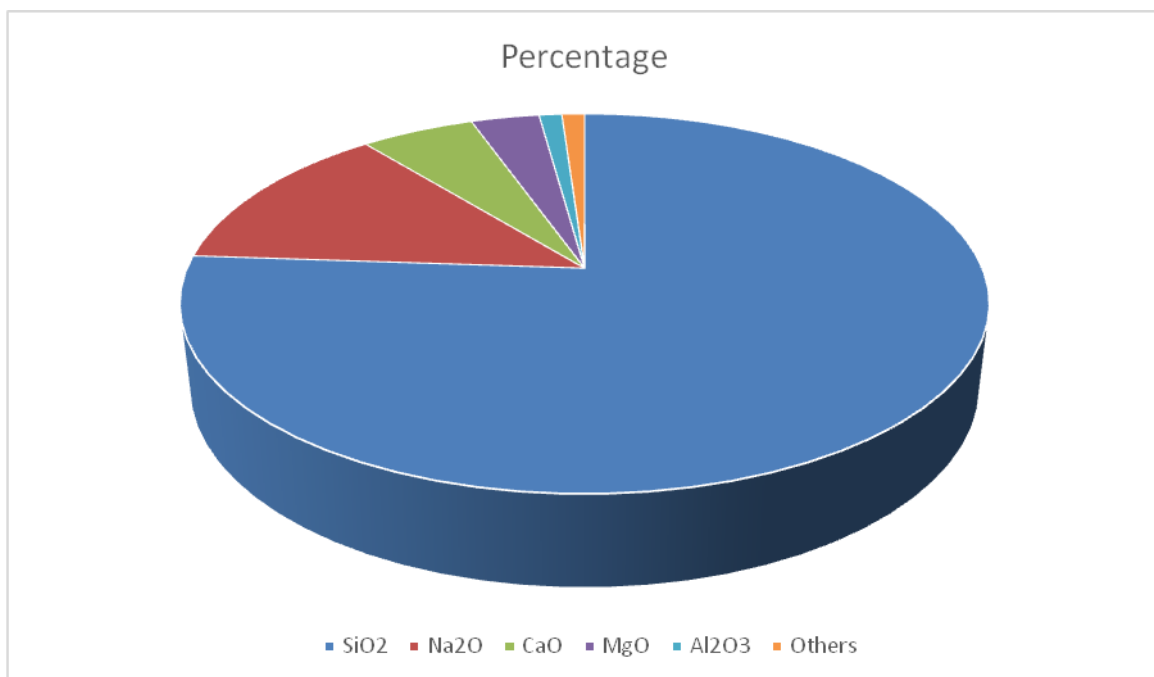
II. MATERIALS USED

These are the following materials used in different percentages with glass powder. These are mixes according to mix design.

- a) Glass powder
- b) Cement
- c) Fine aggregates
- d) Coarse aggregates

A -GLASS POWDER: It is mixed in various percentages in the design as 0%, 7.5%, 15%, and 22.5%. The glass powder used in the present study is bought from Ropar Market. This material replaces the mix in cement proportion.

Chart 2.1:Chemical composition of Glass Powder



B- CEMENT: - it is reduced as we increase the amount of Glass powder. We use OPC Cement in our study of Grade 53.

The various properties of cement of grade 53 is

Table 2.1: Initial properties of Cement

Properties	Values
Fineness	2%
Setting Time	120 minutes
Final Setting Time	600 minutes
Expansion	4mm by soundness test
Specific Gravity of Cement	2.8
Particle Size	<90 micron
Characteristics Compressive Strength	40MPA

C- FINE and COARSE: Aggregate is mixed according to the design mix.

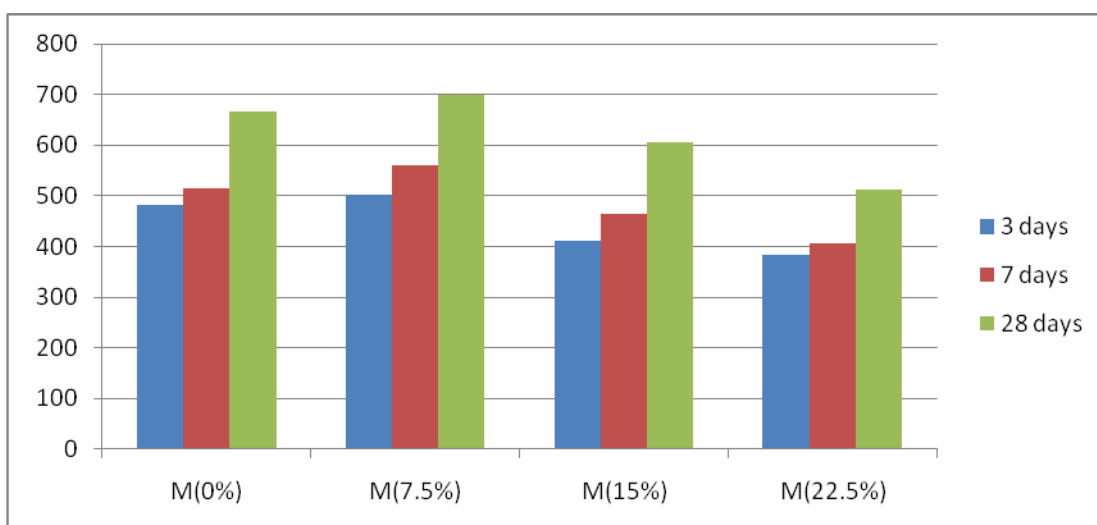
Table 2.2: Initial Properties of Aggregates

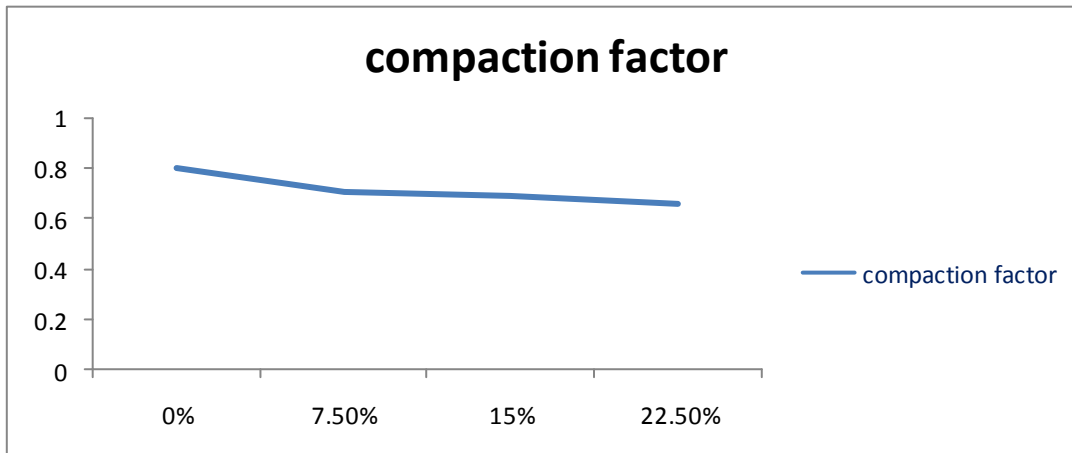
Aggregate Properties	Value
Specific Gravity of Coarse Aggregates	2.6
Specific Gravity of Fine Aggregates	2.6

The Used Design Mix: 1:1.43:2.44

III. EXPERIMENTAL FINDINGS

3.1: Comparative Compressive Strength of various percentage replacement of Waste Glass Powder with Cement



3.2: Experimental Result of Compaction Factor Test to determine Workability of concrete**IV. CONCLUSION**

As glass is an inert material which means it do not react with the cement sand or any of the aggregate added in the concrete shows the increase in compressive strength of concrete. The only reason protected about the increase of compressive strength of concrete with bearing percentage of glass powder was that may be due to poor refinement.

The results obtained from the above experiment are as follows:-

1. There was increase in compressive strength with replacement of glass powder to 22.5%.
2. The optimum replacement of glass powder is 7.5%.
3. The workability decreases slightly with increase in percentage of glass powder.

Hence, concluded that glass powder can be used as a cement replacement up to 22.5%, which will reduce the cost of construction as well as increase the strength of concrete.

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