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Experiment On Replacing Of Cement By Glass Powder In Concrete

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Abstract : In the recent year there has been massive use of cement everywhere in India and other country especially in the developing country but we know that as a B. tech student everything is limited in this world and we try to find different ways to improve and replace those material or products which are limited so we have been researching on glass powder. Every year the demand is increasing with a great number. One of the main reasons is to use the waste and recycle the waste in the society or in our locality. The glass powder will test with concrete and mortar. Cement was replaced by Glass Powder in the proportion of 0%, 10%, 15%, 20% and 25% for M30 Grade of concrete with 0.50 water cement ratio. The Experimental investigation on strength properties of glass powder reinforced concrete composite is carried out and compared with normal conventional concrete. The result showed that with increase in percentage of glass powder compressive strength of concrete is also increase. The advantages of this project is replace the cement with cheap and recycled product.

Key Words – Recycle , Cheap , Strength

I. INTRODUCTION

Construction is a group of processes involved during the making of houses, bridges and many work. Due to increase in the urbanisation, the construction is also taking place on large scale. Due to increase in the scale of construction the demands of construction materials is getting higher so, it is important for us to find the alternatives that can replace the conventional construction materials.

Glass powder can be a replacement of cement in construction area. It is the powder produced from the waste glass.as we all know glass are useless at the end of disposed easily near to dumping site, so it is important for us to find some way to use the waste glass and glass powder can be one of the Bestway to reuse the glasses to replace cement because if we introduce glass in cement. The cement became alkali and increase the quality of cementing properties.

OBJECTIVES

The objective of our project is to find an alternative of cement.

- To find the way to reuse the waste glass.
- To develop an environment eco-friendly material available at very low cost.
- To increase the strength of the cement than OPC.
- To make surrounding clean.

SCOPE

- Glass powder mortar are more cohesive than cement mortar.

- It doesn't need any extra admixture when glass powder and concrete are mixed.

II. MATERIAL

Material used

- Water glass powder
- Cement
- aggregate
 - fine aggregate
 - coarse aggregate

Cement

Cement is a binding material used in this project. Cement is a finely milled mineral powder usually grey in colour. The most important raw material for the production of cement are limestone and clay. Cement is when mixed with water, a chemical reaction take place as a result of which cement pastes set and harden to atone mass. The specific gravity of cement is 3.15. The initial and final setting time is 30 minute and 60 minutes respectively.

Fine aggregate

The largest size that falls under the limits of the exact set is 4.75mm. The specific gravity of aggregate is 2.75 under fineness modulus 3.34.

Coarse aggregate

Crushed aggregates available from local source has been used. Aggregate that are large enough to be retained on the 4.75mm sieve size and cannot reach a maximum size of 63mm. The coarse aggregates with a maximum size 20mm having specific gravity value of 2.885 and fineness modulus of 7.36 are used as coarse aggregates. The water absorption is 0.504%.

Glass powder

Glass is an amorphous & transparent material, which is super-cooled liquid and not a solid. Glass can be made verity of forms and sizes from small fibre to meter-sizes pieces. Primarily less is produced by melting a mixture of materials such as silica CaCO_3 , and soda ash at high temperature followed by cooling during which solidification occurs without crystallization Class has been used as aggregates in road construction, masonry and building materials. Before adding glass powder in the concrete, it has to be powdered to desired size. Waste glass available locally in shops is be collected and made into glass powder. Glass waste is very hard material. Glass powder is obtained from Crushing of glass Pieces A Glass powder can be used as cement replacement material up to particle size less than 90 micro.

The Waste glass is sieved into 10 mm and 5 mm particle size for different purposes. Waste glass of 10 mm particle size is usually used as natural aggregate replacement while 5 mm particle size waste glass is used as sand replacement in mortar. Finally, the small particle size is ground to produce glass powder which possesses natural strength minimum water absorption and the capability to encounter excessive temperature without deterioration. Ground Glass powder with particle size 75-150 m can be used as a pozzolan for cement replacement in concrete.

Sources of Glass powder

1. Near small Restaurants.
2. Our college provided us the fused blabs.
3. Waste Collection area in our locality.

Properties of Material

The physical properties, chemical properties and chemical composition of Glass Powder are represented in tables 1, 2 and 3

Table 1. physical properties of Glass powder

S.N.	Physical properties of glass powder	
1	Specific gravity	2.6
2	Fineness passing 150 μm	99.5
3	Fineness passing 90 μm	98

Table 2 Chemical properties of glass powder

S.N.	Chemical properties of glass powder	
1	pH	10.25
2	colour	Greyish white

Table 3. Chemical composition of glass powder

S.N.	Chemical composition of glass powder	% By mass
1	SiO ₂	67.330
2	Al ₂ O ₃	2.620
3	Fe ₂ O ₃	1.42
4	TiO ₂	0.15
5	CaO	12.45
6	MgO	2.73
7	Na ₂ O	12.05
8	K ₂ O	0.638
9	ZrO ₂	0.019
10	ZnO	0.008
11	SrO	0.016
12	P ₂ O ₅	0.051
13	NiO	0.014
14	CuO	0.009
15	Cr ₂ O ₃	0.022

III. METHODOLOGY

Mix Proportion And Experiment

Mix designed of concrete and the experiment work carried out by the help of IS 10262-2009. On the test specimen to study the strength related properties of concrete was explain in below.

Table 4. mix-design

Materials(kg)	Trial1	Trial2	Trial3	Trial4
Cement	1	1	1	1
Fine aggregate	1.85	1.94	1.99	1.92
Coarse aggregate	2.89	3.02	2.74	2.88
w/c ratio	0.5	0.5	0.5	0.5

The mixing process was done using an electrically operated concrete mixer of 0.04 m³ capacity. The concrete making and mixing in the laboratory. The batching procedure was as follows:

- 1) Add coarse, fine aggregate mixing for about 3-5 minutes
- 2) Add cement than mixing for about 1-2 minutes.
- 3) Add approximately two-thirds of water slowly and mix for 2-3minutes.
- 4) Add fiber with water than mixing for 3-4 minutes.

Test to be conducted on the specimens:

Compressive strength

- 7 days specimens age
- 14 days specimens age
- 28 days specimens age

Compressive Strength of Concrete

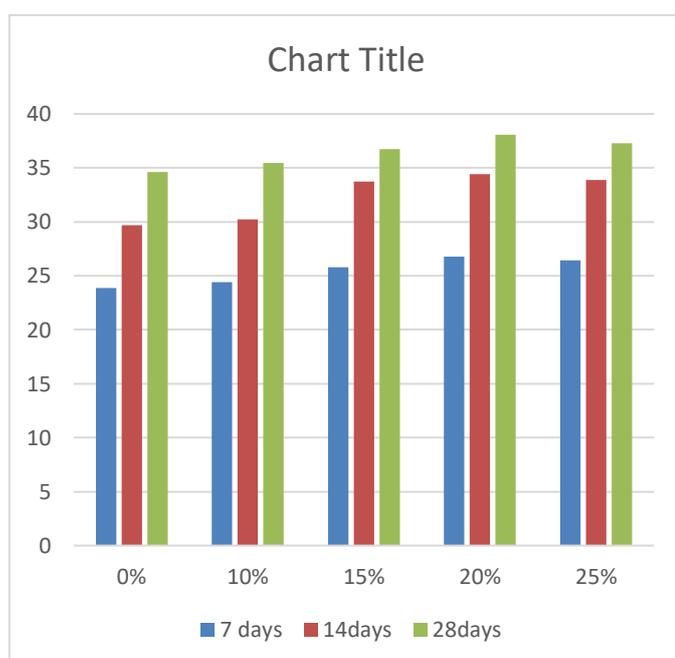
Compressive strength is the ability of material or structure to carry the loads on its surface without any crack or deflection. A material under compression tends to reduce the size, while in tension, size elongates. Compressive strength formula for any material is the load applied at the point of failure to the cross-section area of the face on which load was applied.

$$\text{Compressive Strength} = \text{Load} / \text{Cross-sectional Area}$$

For cube test two types of specimens either cubes of 15cm X 15cm X 15cm or 10cm X 10cm x 10cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15cm x 15cm x 15cm are commonly used.

Table 5 compressive strength result of concrete

Sr.no	%Replacement of glass powder	Compressive strength of concrete for M30 grade concrete (N/mm ²)		
		7 days	14 days	28days
1	0	23.82	29.61	34.04
2	10	24.38	30.14	35.47
3	15	25.72	33.07	36.75
4	20	26.76	34.41	38.09
5	25	26.35	33.89	37.26



IV. Conclusion

Based on limited study and experimental work on concrete containing Glass powder following conclusion are made

- The workability of concrete is increase with increase in percentage of glass powder.
- The compressive strength of concrete is increase with increase in percentage of glass powder.
- Considering the strength criteria, the replacement of cement by glass powder is feasible up to 20%.
- The Durability of concrete is increase with increase in percentage of glass powder.
- Usage of waste glam powder in concrete can prove to be economical us it is very much cheaper than cement.
- Use of waste glass in concrete will reduce the disposal problem of waste glass and prove to be environmentally friendly.
- It is recommended that of glass powder in concrete as cement replacement is possible.

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