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UPFLOW ANAEROBIC SLUDGE BLANKET

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ABSTRACT
This study was conducted to examine the effect of using waste glass powder 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 thedensity test, workability test and compressive strength test. The workability of concrete is determined using slump test and compacting factor test. Meanwhile, compressive strength test is done to determine the strength of concrete. For each type of concrete, aall of six 150mm x 150mm x 150mm cubes were cast. The cubes were tested after 7, 14 and 28 days to study the development of compressive strength. The results show that the concrete with using waste glass powder were able to increase the workability of concrete and also the compressive strength. However, the density is reduced compare to standard mixture of concrete

Keywords: - *Waste glass powder in concrete, workability of concrete and standard mixture of concrete*

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1. INTRODUCTION

Concrete is a mixture of cement, sand, coarse aggregate and water. The key factor that adds value to concrete is that it can be designed to withstand harshest environments significant role. Today global warming and environmental damage have become manifest harms in recent years, concern about environmental issues, and a changeover from the mass-waste, mass-consumption, mass-production society of the past to a zero-emanation society is now viewed as important. Normally glass does not damage the environment in any way because it does not give off pollutants, but it can harm humans as well as animals, if not dealt cautiously and it is less friendly to environment because it is non-biodegradable. Thus, the development of new technologies has been required. The term glass contains several chemical diversities including soda-lime silicate glass, alkali-silicate glass and boro-silicate glass. To date, these types of glasses glass powder have been broadly used in cement and aggregate mixture as pozzolana for civil works. The introduction of waste glass in cement will increase the alkali content in the cement. It also help out in bricks and ceramic manufacture and it preserves raw materials, decreases energy consumption and volume of waste sent to landfill. As useful recycled materials, glasses and glass powder are mainly used in fields related to civil engineering, for example, in cement, as glass powder (supplementary cementitious materials), and coarse aggregate. Their recycling ratio is close to 100%, and it is also used in concrete without adverse effects in concrete durability. Therefore, it is considered ideal for recycling

Recently, Glasses and its powder has been used as a construction material to decrease environmental problems. The coarse and fine glass aggregates could cause ASR(alkali-silica reaction) in concrete , but the glass powder could restrain their ASR tendency, an effect similar to supplementary cementations materials (SCMs). Therefore,glass is used as a replacement of supplementary cementitious materials.

Table 1: Physical and chemical properties of cement, sand, aggregate and glass powder

Sr. No.	Property	Specific Gravity		Colour
1	Cement	3.15	9	Gray
2	Sand	2.65	7.0	Yellow
3	Aggregate	2.9	5.4	White
4	Glass	2.6	10.25	Greyish

Table 2: Chemical composition of cement and glass powder

Sr. No.	Chemical Composition	% By Mass	
		Cement	Glass
1	Sio_2	20.20	67.33
2	Al_2O_3	4.7	2.62
3	Fe_2O_3	3.00	1.42

4	Tio_2	------	0.157

1.Methodology

A nominal mix of concrete of proportion 1:2:4 was adopted for this study. The first mix MC1 is control mix having only cement as binder. The MCF series had fly ash as replacement of cement. The MCS & MCG series had silica fume and glass powder as replacement of cement. The compressive strength test were conducted to monitor the strength development of concrte containing 10%, 15% &20% of these glass waste as cement replacement. The particle size effect of glass powder studied by using glass powder of size (150-100)µ and (50-100)µ. Capillary absorption test is perform to study the effect of alkali aggregate reaction.

The EDS analysis and SEM analysis of the mixes were done to study the change in the morphological characteristics of concrete mixes

- The tests were conducted in two series.
- In first Series 10 % of waste glass powder were used as partial replacement of cement.
- In second series 15% of waste glass powder were used as partial replacement of cement.
- In second series 20% of waste glass powder were used as partial replacement of cement.

• Eleven numbers of standard cubes (150x150x150 mm) were cast to measure the compressive strength after 7,14& 28 days. Two cube were retained to measure capillary absorption after 7, 14 & 28 days respectively.

To study the characteristics following tests were conducted:

Normal consistency

Normal consistency of different binder mixes determined by using the procedure referring to IS 4031: part 4 (1988) :

• 300 gram of sample coarser than 150µ sieve is taken.

• Approximate percentage of water added to sample and mixed methodically for 2-3 minutes.

• After applying oil to the surface of mould, paste was fill in the vicat's mould and was placed under the needle of vicat's apparatus.

• Release quickly the needle allowing it to sink in the paste and note down the penetration reading when the needle becomes stable.

• If the penetration reading is less than 5 to 7 mm, prepare the paste once more with more water and repeat the above procedure until the needle penetrate to a depth of 5 to 7 mm.

• The percentage of the water with which the above situation is satisfied is called normal consistency.

Compressive Strength Test

For each series of five set were cast to determine compressive strength. Each set comprises of eleven standard cubes out of which nine cubes were cast to determine the compressive strength after 7, 14 & 28 days. The size of the cube is as per the IS code 10086 – 1982.

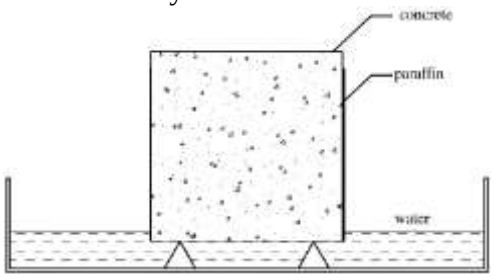
FIG. 2 Compressive Strength

DAYS	7 days	14 days	28 days
Controlled sample	19	26	33
10% of WGP	19	22	30
15% of WGP	20	23	33
20% of WGP	20	29	35

Compressive Strength (N/Mm^2)

Capillary absorption Test

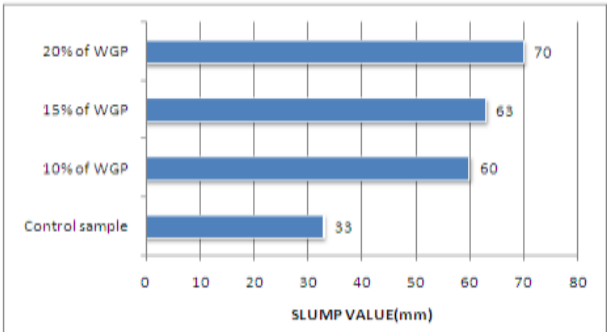
Out of eleven standard cubes two cubes were retained to determine capillary absorption coefficients after 28 days and 52 days curing respectively. This test is conducted to measure the capillary absorption which indirectly measures the durability.



Procedure

- The sample was dried out in oven at 105ºC until constant mass was obtained.
- Sample was cool down to room temperature for 6hr.
- The side of the sample was coated with paraffin to attain unidirectional flow.
- The sample was out in the open to water on one side by placing it on a pan filled with the water.
- The water in the pan was kept about 5mm above the base of the specimen as shown in the figure below.
- The weight of the sample was measured at 15 and 30 minutes intervals.
- 20

- The capillary absorption coefficient (k) was calculated by using formula:
  - k= Q/A* sqrt (t)
  - where, Q= amount of water absorbed
  - A = cross sectional area in contact with water
  - t = time



3.2 Advantages of Using Glass Powder

1. Glass powder concrete increases the compressive, tensile and flexural strength effectively, when compared with conventional concrete.
2. Consuming glass powder in concrete saves its landfills and concrete price
3. Glass powder improves pore structure and durability of concrete
4. Glass powder reduce chloride-ion penetration of concrete to 1/3

Disadvantage of using glass powder

1. It reduces the bonding
2. The tracking and swelling due to alkali-silica reaction

4. CONCLUSION

1. Decrease in the value of slump.
2. The coefficient of capillary absorption test also indicates that incorporation of finer glass powder improves durability
3. The smaller particle size of the glass powder has higher activity with lime resulting in higher compressive strength in the concrete mix.

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