



EFFECT OF GLASS REINFORCEMENT AND GLASS POWDER ON THE CHARACTERISTICS OF CONCRETE

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ABSTRACT

The aim of this study is to analyze the effect of addition of glass powder and glass fiber on the various characteristics of concrete. Waste glass powder and glass fiber is added in different portions and M-25 concrete samples are prepared. These samples are tested for their strength and workability characteristics and the results are compared. It is found that the glass fiber reinforced concrete has better strength than that of glass powder mixed concrete. It is observed that glass fiber gives better results as compared to glass powder. It is found that strength and workability of mixes increases significantly when glass fiber is used.

Key words: Composite Material, Concrete, Glass Powder, Glass Fiber.

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1. INTRODUCTION

Waste management is a big challenge in the present time. Indian glass industry produces huge amount of glass waste. Glass waste is difficult to dispose. Generally glass wastes are disposed on land which is not an economical solution. Glass fiber reinforced concrete is a matrix composed of cement, sand, water and admixtures. The fiber passing through 2.36mm IS sieve is replaced by some percentage of coarse aggregate. It has been broadly used in the structural engineering for non-structural elements like facade panels, piping and channels. Glass fiber reinforced concrete (GFRC) has many advantages, such as:

1. It is light in weight
2. It has fire resistance property. So, it can be used as a fire resistant material
3. It has better strength properties

A simple concrete has very low tensile strength, limited ductility and little resistance to cracking. Glass fiber when used as supplementary material in certain percentage in concrete will improve the strain properties as well help in cracks resistance (Purkiss; 1985). It also improves ductility, toughness and flexural strength. Steel fiber is also used in construction but in modern era glass fiber is preferred which is free from corrosion crisis. They are largely used in external building facade panels and as architectural precast concrete. This material is very fine in construction shapes on the front view of any building and is less dense than that of steel.

Glass fiber is used in various studies to improve the properties of concrete. It's found that the bleeding of concrete can be reduced if glass fiber is used. It improves fire resisting properties of the concrete (Chandarmouli et al; 2010). In the present study, glass fiber is mixed in proportion of 1.5% and 2.0% in concrete mix. The amount of glass powder varies from 10 to 20%. The various tests for workability and compression strength are performed and the results are compared.

2. MATERIALS AND METHOD

The aggregate is used primarily for purpose of providing bulk to the concrete. To increase the density of resulting mix the aggregates is frequently used in two or more size. Coarse aggregates have specific gravity 2.65 and bulk density is 6. Maximum size of coarse aggregate is 20 mm and nominal size is taken 16mm.



Figure 1 Glass Fiber and Glass Powder

The most important function of fine aggregates is to assist in producing workability. The fine aggregates also assist the cement paste to hold the coarse aggregates particle in suspension. The aggregates provide 75 % of the body of concrete and hence its influence is

extremely important. River sand is used as fine aggregates. Specific gravity of fine aggregates is 2.60. Bulk density of fine aggregates is found to be 1700 Kg/m^3 and fineness modulus is 2.30. The cement used is 43 grade ordinary Portland cement. Specific gravity of cement is 3.15 and bulk density is 1450 Kg/m^3 .

Glass fiber is that material which in certain percentage used in reinforced concrete increases the strength and ductility of concrete. Glass powder is raw or waste material which used in reinforced concrete with various water cement ratio increase the strength of concrete. Water cement ratio is taken as 0.42.

3. RESULTS AND DISCUSSION

Workability and compression strength tests are performed on the prepared samples. The results of workability tests are shown in Table 1.

Table 1 Effect of glass powder and glass fiber on workability

Serial No.	Concrete	w/c ratio	Slump (mm)
1	ordinary	.43	20
2	1.5% G.F	.43	30
3	2% G.F	.43	30
4	10% G.P (Trial I)	.43	23
5	20% G.P (Trail I)	.43	23

It is found that the workability increases significantly with the mixture of glass fiber while there is not much increase in workability due to mixture of glass powder. But in both cases the workability is more as compared to that of ordinary concrete. Figure 2 shows the slump of the composite concrete.



Figure 2 Slump Test

Compression test is performed on the 42 number of cubes. The cubes prepared with ordinary concrete and composite concrete are shown in figure 3.



Figure 3 Concrete Cubes

The compression strength is evaluated. Figure 4 shows the effect of mixing glass fiber on the compression strength of ordinary concrete. The compression strength results are compared with strength of ordinary concrete it is observed that the strength has been increased significantly when glass fiber is used. As the amount of glass fiber is increased from 1.5% to 2%, the strength decreased little bit but still it is much higher than ordinary concrete.

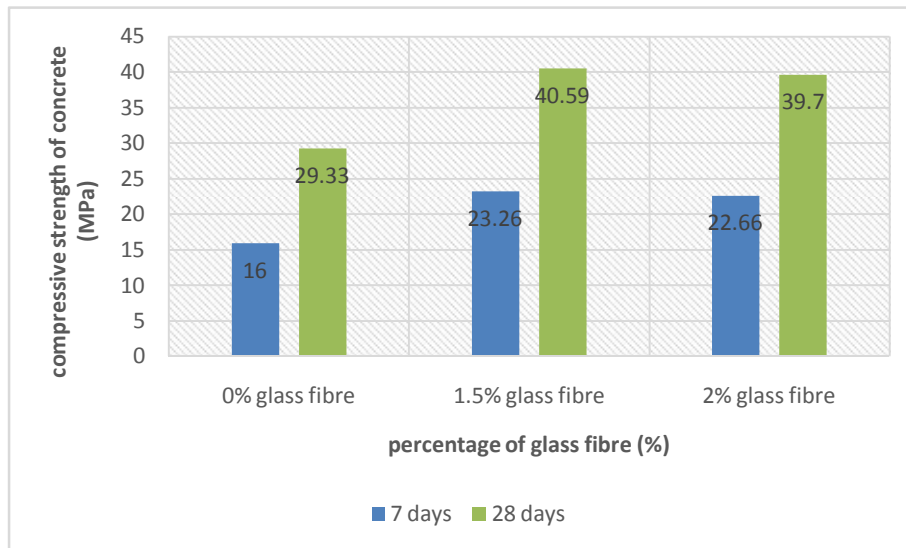


Figure 4 Effect of glass fiber on concrete

Glass powder is mixed in 10%, 15% and 20% amount. It is found that the strength increased significantly initially but as the amount of glass powder is increased beyond 15%, the strength starts decreasing. The effect of glass powder on strength of concrete is shown in figure 5.

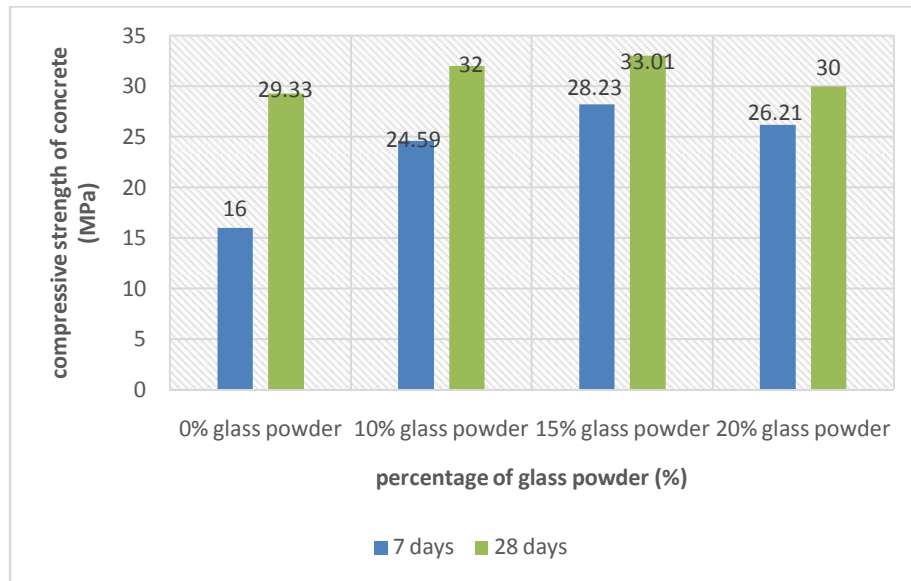


Figure 5 Effect of glass powder on concrete

It can be observed from the figure 5, that there is significant increase in the 7 day strength of concrete on mixing glass powder but final strength doesn't increase much. The final strength changed by only 1% when the amount of glass powder is varied from 10% to 15%.

4. CONCLUSION

It can be concluded that glass powder and glass fiber both can be used in concrete to enhance its strength and workability, but glass powder don't increase much final strength while glass fiber gives better results. So, glass fiber is a good alternative for improving the properties of ordinary concrete while glass powder also gives better strength as compared to ordinary concrete.

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