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An Experimental Study on Concrete by Partial Replacement of Glass Powder and Quartz Powder in Cement with Steel Fiber

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Abstract : Concrete is one of the most widely used construction materials in the world[3]. There is a need to replace a part of cement by some pozzolanic material to reduce the consumption of cement and the environmental pollution can be checked to some extent. Industrial wastes like fly ash, silica fume, blast furnace slag etc, have already established their usage in concrete. Recently the research has shown that the waste glass can be effectively used in concrete either as glass aggregate or as a glass pozzolanic. Steel fiber is also additional added to increase the strength of concrete based on total consumption of coarse aggregate. Concrete with replacement of cement by waste glass powder such as 20**%,**25**%** and 30**%**.Quartz powder replacement of cement with 5**%**and steel fiber 1**%** of total coarse aggregate and the results was compared with conventional concrete and without steel fiber.
Keywords : Glass powder, Quartz powder, Steel fiber, Compressive strength, split tensile strength.

1.0 Introduction

In recent years, the construction was well developed in the world. Concrete plays a main role in construction field[2,6]. Special concrete is a mixture of cement, fine aggregate, coarse aggregate and some other admixtures. During cement production, it emits lot of carbon di oxide and it affects the environment as well as demand of cement increases day by day[5]. Therefore, lot of research has been done by partial replacement like silica fume, fly ash, and some other by products. In this experiment cement is replaced by the glass powder and quartz powder in certain percentage in cement and also steel fiber is added to the total constituent of coarse aggregate.

Glass powder is the by-product of waste glass which is collected from the small shops[1,4]. It is packed as a waste and disposed in landfills. Glass is amorphous material with high silica content, thus making it potentially pozzolanic when particle size is less than 75μm and the amount of steel fibres added to the concrete mix is expressed as a percentage of total volume of the coarse aggregate. Steel fibre concrete utilises steel fibre designed to provide ultimate performances under intense loading conditions[7]. It resist to cracking in hardened state concrete as well as maximum resistance to damage from heavy impact loading.

2.0 Material

2.1 Glass powder

Glass powder is by-product of waste glass collect from shop. Before replacing in cementfor require size 150 micronsievehas been used.

Physical and Chemical properties

Physical properties	**Chemical properties**
Specific gravity – 2.4	PH – 10.51

2.2 Quartz powder

Physical properties	**Chemical properties**
Specific gravity -2.7	PH- 9.22

2.3 Steel fiber

Steel fibreis added to concrete to improve the structural properties particularly tensile strength. Size of the steel fiberis 0.5mm diameter and 40mm length.

3.0 Experimental results

3.1 Compressive strength

The specimens of size 150 x 150 x 150 mm for the various mix proportion for 20%, 25%, and 30 % partial replacement of cementby glass powder and 5 % of quartz powder. The casted cubes are kept for curing for 7,14and 28 days. Then the cubes are tested in compression testing machine of capacity 2000 KN.

Fig a:Compressive strength for cube

Table: 1 Compressive strength results

Days	**Conventional mix (N/mm^2)**	**Partial added glass and quartz powder with steel fiber (N/mm^2)**		
		20 % (GP), 5 % (QP)& (1% SF) (N/mm^2)	**25 %(GP) 5 % (QP) & (1% SF)(N/mm^2)**	**30 %(GP) 5 % (QP) & (1% SF) (N/mm^2)**
7	29.4	35.18	32.04	30.8
14	34.32	42.15	39.56	37.75
28	37.45	`50.06	45.61	41.34

3.2 Split tensile strength

The split tensile test is done with a cylinder of size 150 mm diameter and 300 mm length specimens with 20%, 25% and 30% partial replacement of cement by glass powder and 5% of quartz powder and additional with 1 % of steel fibre of total quantity of coarse aggregate . The cylinder is kept curing for 7, 14 and

28 days. After curing the specimens are tested in compressive testing machine. Load is applied along the length and the load which the cylinder splits into two halves is noted.

Table: 2 Split tensile strength results

Days	**Conventional mix (N/mm^2)**	**Partial added glass and quartz powder with steel fiber (N/mm^2)**		
		20 % (GP), 5 % (QP) & (1% SF) (N/mm^2)	**25 %(GP) 5 % (QP) & (1% SF) (N/mm^2)**	**30 %(GP) 5 % (QP) & (1% SF) (N/mm^2)**
7	1.8	2.18	2.9	1.7
14	2.4	2.7	3.1	2.08
28	2.76	3.23	3.42	2.56

Fig b:Split tensile strength of cylinder

4.0 Comparative Results

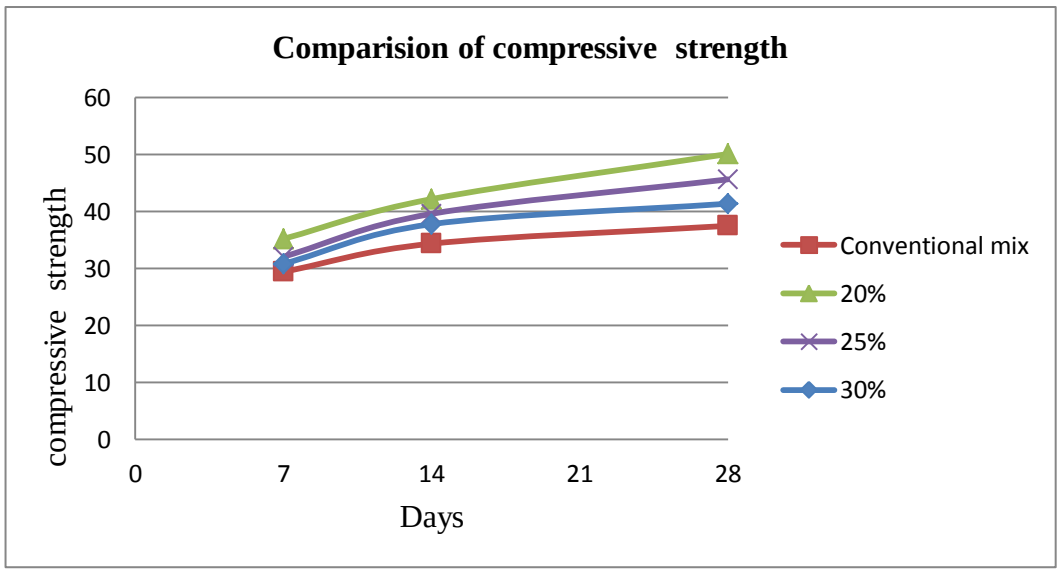

Figure1: Comparison of 28 days results of Compressive strength

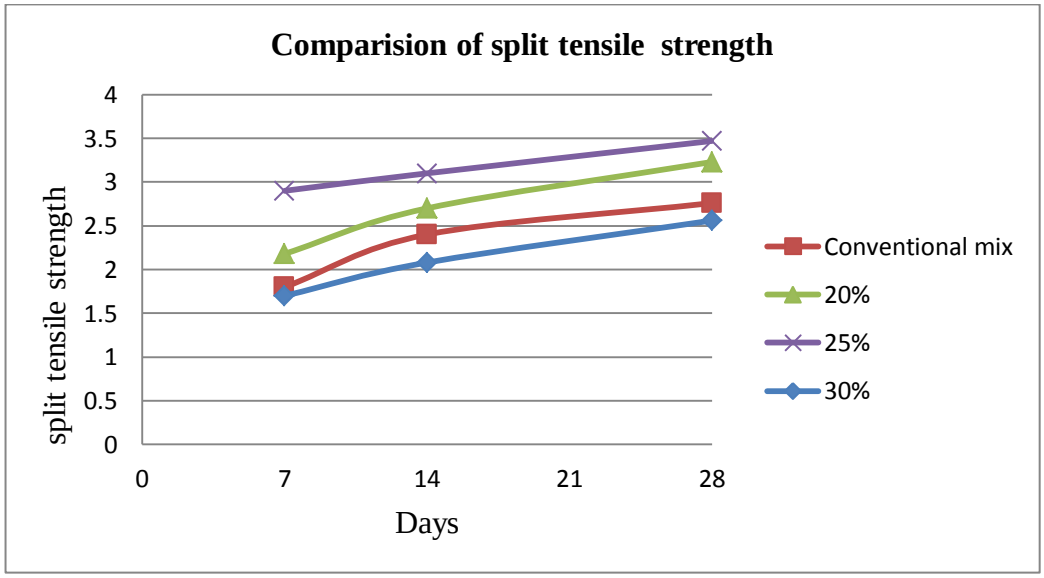

Figure2: Comparison of 28 days results of split tensile strength

5.0 Conclusion

- Conventional concrete shows at 28 days compressive strength as 37.45 N/mm², Split tensile strength as 2.76N/mm².
- Replacement of 5% quartz powder and also glass powder in cement by 20%, 25% and 30% and additional 1% of steel fiber increases the compressive strength by 33.6%, 21.79% and 10.38 % respectively.
- Replacement of 5% quartz powder and also glass powder in cement by 25% and additional 1% of steel fibre increases the split tensile strength by 23.91%respectively.
- Replacement of 5% quartz powder and also glass powder in cement by 20%, 25% and 30% without steel fiber increases the compressive strength by 20.61%, 13.51%, 4.65% respectively.
- Replacement of 5% quartz powder and also glass powder in cement by 25% and without steel fibre increases the split tensile strength by 16.30% respectively.

6.0 References

1. IS 12269. Specification for 53 Grade Ordinary Portlandcement, Bureau of Indian Standards, New Delhi, India, 1987.
2. IS 383. Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi, India, 1970
3. IS 10262. Concrete Mix Proportions Guide Line, Bureau of Indian standards, New Delhi, India, 2009.
4. Ashutosh sharma, Ashutosh Sangamnerkar. A Glass powder – Partial Replacement of cement .International journal of core engineering and management, Feb 2015.
5. JitendraB.Jangid, Prof .A.C.Saoji .Experimental investigation of waste glass powder as a partial replacement of cement in concrete production .IOSR journal of mechanical and civil engineering.
6. ShilpaRaju ,Dr.P.R.Kumar effect of using glass powder in concrete. International journal of innovative research in science, engineering and technology, July 2014.
7. Khadake S.N., Konapure C.G.an Experimental Study of Steel Fiber Reinforced Concrete with Fly Ash for M35 Grade Jan-Feb 2013.

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