COMPRESSIVE STRENGTH STUDY ON GLASS POWDER REPLACEMENT WITH FINE AGGREGATE

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Abstract— Glass powder (GP) used in concrete making leads to greener surroundings. In glass industries, broken glass sheets & sheet glass cuttings are go to waste, which are not recycled at present and usually added to landfills for disposal. The use of GP in concrete is an interesting possibility for economy system on waste disposal sites and conservation of surroundings. This project examines the opportunity of the usage of GP as fine aggregates replacement in concrete. Natural sand changed into partly changed (25%, 50%, 75%, 100%) with GP in concrete. Compressive strength up to 28 days of age had been as compared with the ones of high performance concrete made with natural sand.

key words—Glass powder, compressive strength, economy system.

I. INTRODUCTION

As modern engineering practices become more demanding there is a corresponding need for special types of materials with novel properties. Scientists, Engineers and technologists are continuously on the lookout for materials, which can act as substitute for conventional materials or which possess such properties as would enable new designs and innovations resulting into economy, so that a structure can be built economically.

However on many occasions individual materials as such may not serve the specific purpose. There have been so far many attempts to develop new materials, which is the combination of two or more materials. Such materials are called Composite material.

Concrete can be regarded as a composite material. For reducing the cost of concrete, greater use of pozzolanic materials like fly ash, blast furnace slag and waste glass was suggested. The use of these materials as the substitute material in concrete would reduce the disposal problem faced by thermal power plants and industrial plants and at the same time achieving the required strength of concrete.

Glass is amorphous solid material which is produced at high temperatures followed by crystallization. The effective use of waste glass for partial and full replacement of sand as an admixture in cement mortar and concrete has established in the country in recent years.

Recent investigation of waste glass has indicated greater scope for their utilization as a construction material. Greater utilization of waste glass will lead to not only saving such construction material but also assists in solving the problem of disposal of this waste product.

The recent investigations have also indicated the necessity to provide proper collection methods for waste glass so as to yield waste glass of quality and uniformity, which are primer requirements as waste glass for use as construction.

II. MATERIALS TEST RESULTS

Table1: Physical properties of glass powder

S.No	**Physical properties of glass powder**	
1.	Specific gravity	2.58
2.	Fineness Passing 150µ	99.5
3.	Fineness Passing 90µ	98

Table2: Chemical Properties of glass powder

S.No	**Chemical Properties of glass powder**	
1.	pH	10.25
2.	Colour	Grayish White

Table3:Chemical Properties of glass powder

S .NO	**Chemical properties of glass powder**	**% By Mass**
1.	SiO_2	67.330
2.	$Al2O_3$	2.620
3.	Fe_2O3	1.420
4.	TiO_2	0.157
5.	CaO	12.450
6.	MgO	2.738
7.	Na_2 O	12.050
8.	K_2O	0.638

9.	ZrO_2	0.019
10.	ZnO	0.008
11.	SrO	0.016
12.	P_2O_5	0.051
13.	NiO	0.014
14.	CuO	0.009
15.	Cr_2O_3	0.022

Fig1: Showing waste glass

Fig2: Showing Concrete in Cubes

Table4: Physical Properties of ordinary Portland cement ANJANI 43 Grade

S.NO.	**PROPERTY.**	**TEST RESULTS.**
1	Normal consistency	35%
2	Specific gravity	3.15
3	Initial setting time	145 minutes.
	Final setting time.	370 minutes.
4	Fineness of cement (Dry sieving method)	98%

Table5:Physical Properties of Glass Powder

S.NO.	PROPERTY.	TEST RESULTS.
1	Specific gravity	2.56

Table6:Physical Properties of Fine aggregate (Sand)

S.NO.	**PROPERTY.**	**TEST RESULTS.**
1	Specific gravity	2.66

Table6: Physical Properties of Coarse aggregate

S.NO.	**PROPERTY.**	**TEST RESULTS.**
1	Specific gravity	2.6
2	Fines Modulus	8.63

III. MIX DESIGN

Table7: Material required for M35 grade concrete per m3 quantity of concrete

Material	Water	Cement	Fine Aggregate	Coarse Aggregate
Kgs/cum	191.6	563.52	454.85	1141.11
Ratio	0.34	1	0.80	2.02

Table8: Material required for M40 grade concrete per m3 quantity of concrete

Material	Water	Cement	Fine Aggregate	Coarse Aggregate
Kgs/cum	185.4	598.06	355.72	1225.25
Ratio	0.31	1	0.59	2.04

IV. TEST RESULTS:

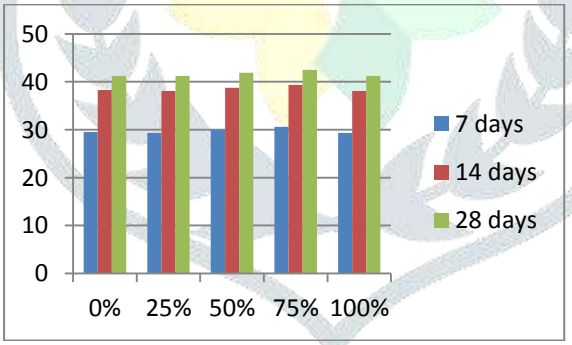
Table9: Compressive strength Results for replacement of Sand by Glass for M35

S.no	Replacement by waste Glass (%)	7 - Days	14 - Days	28 - Days
1	0	29.55	38.3	41.45
2	25	29.33	38.08	41.23
3	50	30	38.75	41.9
4	75	30.6	39.35	42.5
5	100	29.33	38.08	41.23

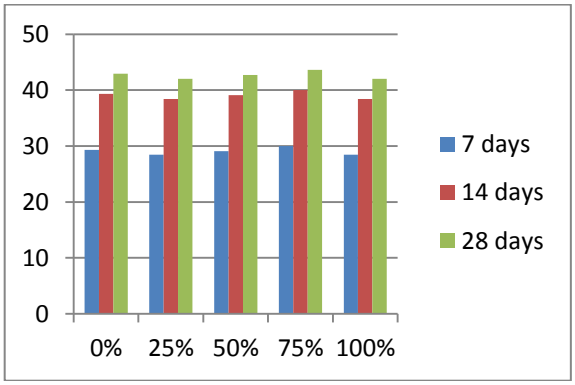
Table10: Compressive strength Results for replacement of Sand by Glass for M40

S.no	Replacement by waste Glass (%)	7 - Days	14 - Days	28 - Days
1	0	29.33	39.33	42.93
2	25	28.44	38.44	42.04
3	50	29.11	39.11	42.71
4	75	30	40	43.60
5	100	28.44	38.44	42.04

V. GRAPHS



Graph1: Graphical Representation of Compressive Strength Values for M35



Graph2: Graphical Representation of Compressive Strength Values for M40

VI. CONCLUSION

From the above study we conclude that the compressive strength of the concrete cubes has gradually increased up addition of 75% of waste glass. Compared to compressive strengths of 25%, 50%, 75%, 100% addition of waste glass, the compressive Strength of 100% waste glass concrete has been reduced. Whereas evaluating to traditional concrete, compressive strength of 75% has been accelerated. Hence for economical view 50% is preferable and in the perspective of compressive strength 75% is suggested.

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