AN EXPERIMENTAL STUDY ON EFFECTIVE UTILIZATION OF GLASS POWDER IN CONCRETE

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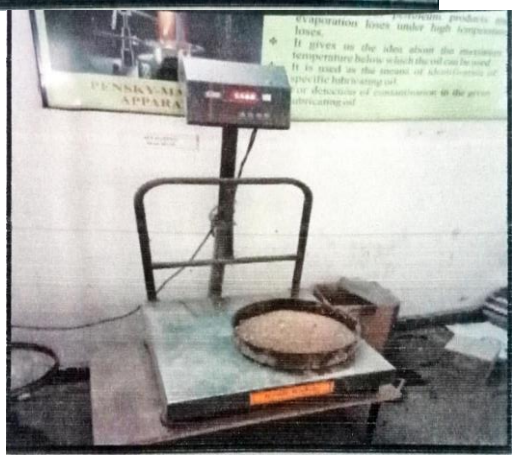
ABSTRACT: This experimental study aims to investigate the potential use of glass powder as a partial replacement for cement in concrete. The project explores the effects of different proportions of glass powder on the compressive strength, workability, and durability of concrete. Various mix designs were prepared by replacing cement with different percentages of glass powder and tested using standard procedures. The results obtained showed that incorporating glass powder in concrete led to a significant improvement in compressive strength, workability, and durability. Moreover, the study found that using glass powder as a partial replacement for cement in concrete can contribute to sustainable development by reducing waste disposal and conserving natural resources. This research provides valuable insights into the use of glass powder in concrete and can guide future efforts to develop more sustainable construction materials.

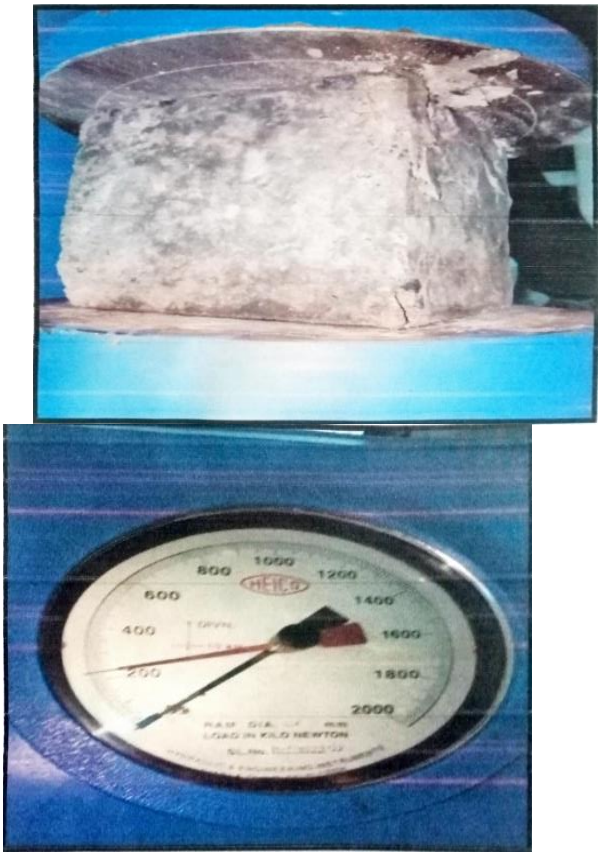
INTRODUCTION

Concrete is a blend of cement, sand, coarse aggregate factor that adds value to concrete is that it can be designed to environments significant role. Today global warming devastation have become manifest harms in recent environmental issues, and a changeover from the mass-waste, and mass-production society of the past to a zero-emanation as significant. Concrete is a widely used construction cementing material, fine aggregate, coarse aggregate and water. Concrete is one of the world's most used construction versatility, durability and economy. India uses about 7.3 million ready-mixed concrete each year. It finds application in highways, high-rise buildings, dams etc. Greenhouse gas like CO2 leads and it contributes to about 65% of global warming. The global emits about 7% of greenhouse gas to the atmosphere. To reduce impact alternative binders are introduced to make concrete.

Natural resources are of two types- the renewable and Renewable resources which can be recycled again and again our benefits. But non- renewable resources are those, which utilized are lost forever. The major problem facing by mankind utilization of natural resources in order to meet the human needs economic growth without exhausting the resources and environmental integral on which life economic prosperity and our The worldwide utilization of regular cement is high because of the of cement. Specifically, the interest for regular cement is high in inferable from quick infrastructural development, buildings and since cement assumes the critical part and a substantial quantum In this manner searching for a substitution to stream cement has and major issue.



Due to various factories and industries large volume of waste produced daily. The disposal of the waste generated from industries has become serious issue solid waste management is one of the major environmental concerns in the world. The recycling and reuse of the waste has become the best alternatives as their disposal problem of waste . The reuse of such waste will reduce the environment impact and is more economical the energy required to reuse the recyclable material is less than that of virgin materials. The utilization of these waste products in construction industry is best option due to large number of construction site all over the world According to the World Commission on environment and Development: Sustainability means "Meeting the needs of the present without compromising the ability of the future generations to meet their own needs."



EXPERIMENTATION

This chapter describes the materials used, the preparation of the test specimens and the test procedures. All the tests and the results shall be shown from appropriate table and graph that can be prepared simultaneously. In order to achieve the stated objectives, this study is carried out in few stages. On the initial stage, all the materials and equipment's needed must be gathered or checked for availability. Then, waste paper pulp and marble waste is material applied as partial replacement of cement and fine aggregates respectively in manufacturing fresh concrete used in the concrete mixes according to the predefined proportions. Once the characteristic of the materials selected has been tested through appropriate tests, the applicable standard of specification should be referred. Finally, the results obtained were analyzed to draw out conclusion. The flow chart of all the stages is indicated

A total of eight series of concrete specimens including the control specimen were prepared in order to examine the effect of substituting Glass Powder (0, 10, 20, 30 and 40% by weight) in place of cement to investigate the basic strength properties of concrete. For each mix six samples of cube were prepared.

CASTING DETAIL

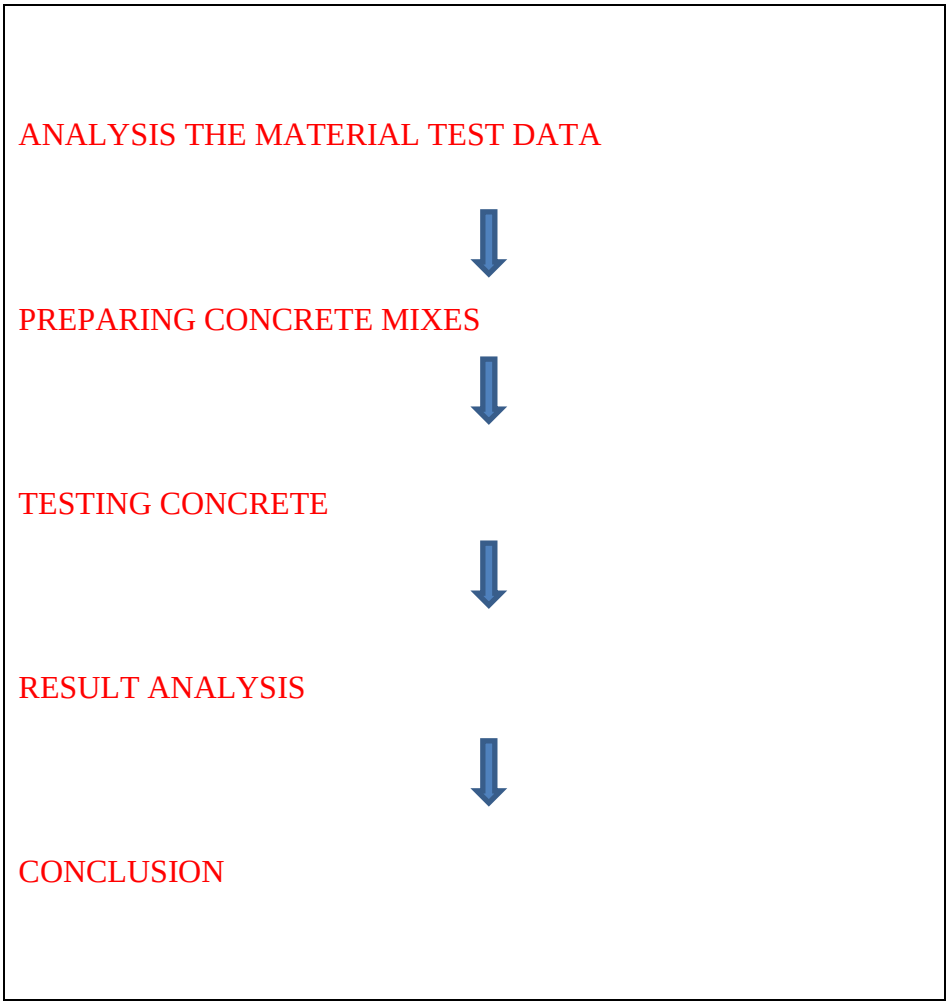
Ordinary Portland cement (OPC), grade 43 is used throughout the investigation. The Glass powder c btained as an industrial by-product directly from the deposits of Glass factories, which is generated during the sawing, shaping and polishing processes of Glass powder. The coarse aggregate used in this investigation have a maximum size of 20 mm with grading confirming to IS-383-1970. The natural river sand passing through 4.75mm sieves is used throughout the process. Ordinary clean potable tap water free from suspended particles and chemical substances was used for mixing and curing of concrete throughout the experiment.

The design of concrete mix is done as per guidelines of IS 10262 : 2009 with a grade of M20 of concrete. The simple hand mixing method was employed for mixing of concrete. First coarse and fine aggregates are fed alternately, followed by cement. Then required quantity of water was slowly added into the mix to make the concrete workable till it attains a uniform colour. The mixing was done for two minutes for all the ingredients to mix properly.

Compaction of all the specimen was done by using shake table vibrator. The top surface of concrete is levelled, finished smooth by using a trowel and wooden float. The specimen detail and date of concreting was specified on top surface to identify it properly. After six hours, all the concrete specimen were removed from the mould and placed in the curing tank

for 7, 14, 28 days curing purpose. The various tests on the concrete ingredients that were required for the proper design mix were carried out separately and given by

LINE DIAGRAM FOR VALVE

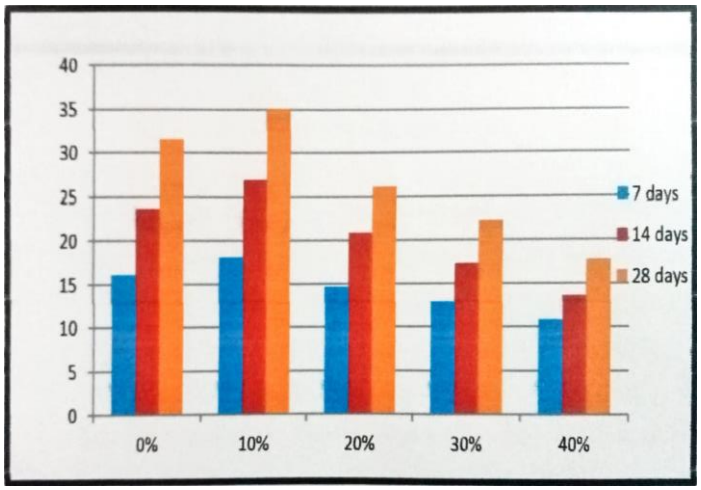


Flow Chart of the Study

Comparative compressive strength for 7, 14, and 28 Days

The compressive strength test result for M20 grade of concrete after 7, 14 and 28 days of curing is as given in below table.

Sr. No.	GP (%)	Comp. Strength (N/mm2)	Avg. Strength (N/mm2)	Comp. Strength (N/mm2)	Avg. Strength (N/mm2)	Comp. Strength (N/mm2)	Avg. Strength (N/mm2)
		7 days		14 days		28 days	
1	0	16.44	16.07	23.11	23.55	31.11	31.85
		16		23.55		32	
		15.55		24		32.44	
2	10	17.33	18.07	27.11	26.92	35.11	35.10
		18.66		27.55		35.55	
		18.20		26.11		34.66	
3	20	15.11	14.66	20.88	20.88	26.22	26.21
		14.66		21.33		26.67	
		14.22		20.44		25.76	
4	30	12.88	12.88	17.77	17.32	22.66	22.21
		12.44		17.33		22.22	
		13.33		16.88		21.77	
5	40	11.55	10.83	13.77	13.62	17.77	17.77
		10.65		14.22		18.22	
		10.22		12.88		17.33	



Observation:

In this graph we can see that the compressive strength of control mix at 7 days for M20 Grade is minimum than 10% to 20% replacement of cement by glass powder. But the compressive strength of control mix is maximum than 30% to 40% replacement of cement by glass powder. Hence from this graph of 10% replacement of cement by glass powder gives 1.06 times more compressive strength at 7 days than control mix. 1.15 times more compressive strength at 14 days than control mix, 1.11 times more compressive strength at 28 days than control mix.
Hence we can concluded that 10% replacement of cement by glass powder gives maximum strength.

CONCLUSION

From this present study it is observed that industrial waste glass powder used in concrete with different proportion. And conclusion obtained are as follows:

i. The increase in strength up to 10% replacement of cement by waste glass powder may be due to pozzolanic reaction of glass powder and it may be due to the glass powder effectively filling the voids and giving rise to dense concrete microstructure. However, beyond 30% the dilution effect takes over and the strength starts to drop. Thus it concludes that 40% waste optimum level for replacement of cement with glass powder.

ii. Very finely ground glass has been shown to be excellent filler and may have sufficient pozzolonic properties to serve as partial cement replacement, the effect of ASR appear to be reduced with finer glass particles, with replacement level.

iii. Considering the strength criteria, the replacement of cement by glass powder is feasible. Therefore we can conclude that the utilization of waste glass powder in concrete as cement replacement is possible.

iv. Used of glass powder in concrete will eradicate the disposal problem of waste glass powder, reduce emission of harmful pollution by cement manufacturer industry into our environment and thus prove to be environment friendly.

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