



# EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF FINE AGGREGATE BY GLASS POWDER

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**Abstract:** Concrete is made up of a variety of materials, including coarse aggregate, fine aggregate, cement, and water, which are mixed in different proportions to achieve a specific strength. The most important material, cement, plays an important role in the production of concrete. The high cost of traditional building materials is a major factor influencing construction costs. This is a necessity-driven search for new types of alternative construction materials. As a coarse aggregate, waste glass in the form of fine aggregate can be used. In testing cubes for workability, compression strength, and flexural strength, the proportion of the mineral and mixtures is used. The effects of glass powder addition on the properties of M40 mortar concrete mix at 28 days three concrete mix with dosages of 20% of the weight concrete mix are briefly discussed in this paper. As mix dosages, a combination of these glass powders will be used. Cubes measuring 15x15x15cm were used to test compressive strength. The result of glass powder concrete curing for 7 days, 14 days, and 28 days.

## I. INTRODUCTION

Concrete is the second most widely used material; however, there are environmental issues associated with its use that must be taken into account. A large volume of waste is produced daily as a result of various factories and industries. The disposal of waste generated by industries has become a significant problem. Solid waste management is one of the world's most pressing environmental issues. Recycling and reusing waste has emerged as the most viable solutions to their waste disposal issues. Reusing such waste has a lower environmental impact and is more cost effective. The energy required to repurpose recyclable materials is less than that required to create new materials. The rapid use of natural aggregates raises concerns about the preservation of natural aggregates sources. Furthermore, operations related to aggregate extraction and processing are the primary sources of environmental concern. In light of these using alternative materials in place of natural aggregate in the production of concrete makes concrete a more sustainable and environmentally friendly construction material. Coconut shell, which is a hard and slow-degrading material, can be crushed to the size of sand and used as a sand substitute. Coconut shells are now also used to make charcoal and activated carbon for food, carbonated drinks, and mineral water filtering. However, in some places, the coconut shell is still underutilized. Coconut shells have a chemical composition that is similar to that of wood.

## II. LITERATURE REVIEW

[1] **Rakesh Sakale (2015)** investigated the effects of replacing fine aggregate with waste glass powder by volume of cement in steps of 10%, 20%, 30%, and 40%, and the effects on compressive strength, split tensile strength, workability, and flexural strength. The compressive, flexural, and split tensile strengths of concrete are found to increase initially as glass powder increases, peaking at around 20%, and then decreasing.

[2] **S.M. Chikhalikar and S.N. Tande (2012)** there is a need to replace a portion of fine aggregate with waste glass powder to reduce fine aggregate consumption and to reduce environmental pollution to some extent. Recently, research has revealed that waste glass can be used as fine aggregate in concrete. Because of its high silica content, waste glass has cementitious properties when ground to a fine powder.

[3] **Moriconi and Naik (2005)** Concrete is the world's second most widely used material. However, the production of Portland cement results in a significant amount of CO<sub>2</sub>, a greenhouse gas, being released into the atmosphere. It is estimated that one ton of Portland cement clinker produces one ton of CO<sub>2</sub> and other greenhouse gases (GHGs).

[4] **Veena V. Bhat, N.Bhavanishankar Rao (2014)** Glass is an indeterminate material with high silica content (SiO<sub>2</sub>) i.e. 72% of waste glass when grounded to very fine powder (600 micron) reacts with alkali in cement & cementations product that help to contribute to the strength development.

[5] **Idir R (2009)** Demand for recycled glass has Considerably decreasing in recent years. Glass is cheaper to store than to recycle, as it is expensive for the recycling process. There are several alternatives for the reuse of waste glass. In order to provide a sustainable solution to glass storage, a potential and incentive way would be to reuse this type of glass in concrete.

### III. MATERIAL USED

#### □ CEMENT:-

Cement is a binder, a substance used in construction to bind materials together by setting, hardening, and adhering to them. Cement is used to bind sand and gravel (aggregate) together and is rarely used alone. Cement is mixed with fine aggregate to make masonry mortar, and sand and gravel aggregates are mixed with cement to make concrete. Cements used in construction are typically inorganic, based on lime or calcium silicate, and can be classified as hydraulic or non-hydraulic, depending on their ability to set in the presence of water. Hydraulic and non-hydraulic cement are two types of cement used in construction. Hydraulic cements (for example, Portland cement) harden due to hydration, which is a chemical reaction that occurs regardless of the amount of water in the mixture; they can harden even when submerged or constantly exposed to wet weather. Non-hydraulic cement does not set in wet or submerged conditions; rather, it dries and reacts with carbon dioxide in the air to set. After setting, it is resistant to chemical attack.

#### □ FINE AGGREGATE:-

Aggregates are inert granular materials like sand, gravel, or crushed stone that serve as a standalone end product. They are also the raw materials used in the production of concrete. Aggregates must be clean, hard, and strong particles that are free of absorbed chemicals, clay coatings, and other fine materials that could cause concrete to deteriorate. Fine aggregate is made up of sands collected from either the land or the sea. Natural sand or crushed stone are the most common fine aggregates, with the majority of particles passing through a 4.75mm sieve. These can come from primary, secondary, or recycled sources, just like coarse aggregates.

#### □ COARSE AGGREGATE:-

Coarse aggregates are particles with a diameter of more than 4.75mm but typically ranging from 9.5mm to 37.5mm. They can come from primary, secondary, or repurposed materials. Land-Won or Marine-Won aggregates are primary, or 'virgin' aggregates. Gravel is a coarse marine-won aggregate, while gravel and crushed rock are coarse land-won aggregates. Gravels make up the majority of coarse aggregate in concrete, with crushed stone accounting for the majority of the rest. Secondary aggregates are materials derived from a wide range of materials that are by-products of extractive operations.

#### □ WASTE GLASS POWDER:-

Waste glass is not just waste, but a new resource. Generally beer, wine bottles and other food jars etc., are among the few normal household glass items put into landfills every day. Glass is generally produced from sand, lime and soda and uses about 40 % more power to produce from raw materials than it does with recycled materials. The glass in light bulbs, cook ware and window panes are not recyclable due to some special additives used to the glass. These additives are ceramics and other impurities that generally contaminate the recycling process.

### IV. RESULT

#### TESTING

##### Compressive Strength Test: -

Compressive strength is the most important of all the physical properties of cement. When cement is used in major structures, a compressive strength test is performed to ensure that the cement is of high quality. Due to excessive shrinkage and cracking of plain cement paste, no strength tests are performed. As a result, the test is conducted using cement, sand, and water-based mortar blocks. Because the quality of sand from various sources varies, this test must be performed with sand of uniform quality.



TABLE -1: Compressive Strength Test

MIX	7 days strength ( N/mm <sup>2</sup> )	14 days strength (N/mm <sup>2</sup> )	28 days strength (N/mm <sup>2</sup> )
Mix -1 (0%)	14.0	20.15	24.5
Mix -2 (20%)	15.55	21.25	27.4

TABLE -2: Slump Test

MIX	W/C Ratio	Slump Value (MM)
Mix -1 (0%)	0.41	50mm
Mix -2 (20%)	0.41	78mm

### V. CONCLUSION

Waste Glass Powder and Cement bag is available in a at the test site, which is material in concrete. Further, it acts as a source of waste disposal for Waste Glass Powder due to its use in construction industry. In addition to that Waste Glass Powder mix will reduce the demand for additional waste disposal infrastructure and decrease the load on existing landfills and incinerators.

## VI. REFERENCES

- [1] Rakesh Sakale, Sourabh Jain and Seema Singh, DzExperimental )nvestigation on Strength of Glass Powder Replacement by Fine Aggregate in Concrete with Different Dosagesdz,)nternational Journal of Advanced Research in Computer Science and Software Engineering, Vol.5, Issue 12, December 2015, pp. 386390, ISSN: 2277-128X.
- [2] Chikhalikar S.M. and Tande S.N. îTT'Ö DzAn Experimental Investigation On Characteristics Properties of Fibre Reinforced Concrete Containing Waste Glass Powder as Pozzolonadz , □th Conference on Our World in Concrete and Structures, Singapore, August.
- [3] BhatVeena V, Rao N. Bhavanishankar Dz)nffluence of Glass Powder On The Properties Of Concretedz )nternational Journal of Engineering Trends andTechnology (IJETT), ISSN: 2319 –8753, Volume16, Number-5, October 2016.
- [4] Idir R., Cyr M., and Tagnit-(amou A. îTT'9Ö DzUse of Waste Glass as Powder and Aggregate in Cement-Based Materialsdz SBE)DCO – 1st International Conference on Sustainable Built Environment Infrastructures in Developing Countries ENSET Oran (Algeria).
- [5] Vandhiyan R., Ramkumar K. and Ramya R.îTT'ÖDzExperimental Study On Replacement Of Fine Aggregate By Glass Powderdz )nternational Journal of Engineering Research and Technology (IJERT) Vol. 2 Issue 5, May, ISSN: 2278-0181.
- [6] VasudevanGunalaan and Pillay Seri GanisKanapathy DzPerformance of Using Waste Glass Powder )n Concrete As Replacement Of Fine Aggregatedz American Journal of Engineering Research (AJER) e-ISSN : 2320-0847 p-ISSN : 2320-0936 Volume-02, Issue-12.
- [7] Dali J.S. and Tande S.N. îTT'Ö DzPerformance of Concrete Containing Mineral Admixtures Subjected to High Temperature dz , □th Conference on Our World in Concrete and Structures, Singapore, August.
- [8] Nwaubani Sunny O. and Poutos Konstantinos I.(2013) DzThe )nfluence of Waste Glass Powder Fineness on the Properties of Cement Mortarsdz )nternational Journal of Application or Innovation in Engineering and Management (IJAIEM) Volume 2, Issue 2, ISSN 2319

