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Experimental Investigation of Waste Glass Powder as Partial Replacement of Cement In Concrete

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Abstract:
Cement manufacturing assiduity is one of the carbon dioxides emitting sources besides deforestation and burning of fossil energies. The global warming is caused by the emigration of hothouse feasts, similar as CO2, to the atmosphere. Among the hothouse feasts, C02 contributes about 65 of global warming. The global cement assiduity contributes about 7 of hothouse gas emigration to the earth's atmosphere. In order to address environmental goods associated with cement manufacturing, there's a need to develop indispensable binders to make concrete. Accordingly, expansive exploration is ongoing into the use of cement reserves, using numerous waste accoutrements and artificial by products. Sweats have been made in the concrete assiduity to use waste glass as partial relief of course or fine summations and cement. In this study, finely pulverized waste glass is used as a partial relief of cement in concrete and compared it with conventional concrete. This work examines the possibility of using Glass greasepaint as a partial relief of cement for new concrete. Glass greasepaint was incompletely replaced as 10, 15, 20 and 25 and tested for its compressive, water immersion and flexural strength of 7 days and 28 days of age and were compared with those of conventional concrete; from the results attained, it's plant that glass greasepaint can be used as cement relief material up to flyspeck size lower than 355µm to help alkali silica reaction. It is found that waste glass powder posses' pozzolanic property but depends upon the fineness and 20% replacement of cement is found to be efficient to increase the compressive and flexural strength. Water absorption of concrete is reduced by replacement of cement at any amount. Operation of scrap tyre waste dust should minimize environmental impact and maximize conservation of natural resources. One possible result for this problem is to incorporate rubber patches into cement- predicated paraphernalia. Scrap tyres can be Shredded into raw paraphernalia for use in hundreds of scruple rubber products. The other part of the problem is that aggregate product for construction purpose is continuously leading to the reduction of natural resources. Also, some countries are depending on imported total and it's surely truly precious. For illustration, the Netherlands doesn't retain its own aggregate and has to import. This concern leads to a largely growing interest for the use of necessary Paraphernalia that can replace the natural aggregates. Therefore, the use of recycled waste tyres as an aggregate can give the result for two major problems the environmental problem created by waste tyres and the reduction of natural resources by aggregate product consequently the deficiency of natural aggregates in some countries. According to the Automotive Tyre Manufacturers Association (ATMA), in India, farther than92.2 million tyres of Various orders were manufactured. Predicated on an estimate, 60 of the waste tyres are disposed off via unknown routs. The raw paraphernalia in tyres include natural and synthetic rubber, carbon dark, nylon, polyester.

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I. INTRODUCTION

Glass is a transparent material produced by melting a mixture of materials such as silica, soda ash, and CaCO3 at high temperature followed by cooling where solidification occurs without crystallization. Glass is an ideal material for recycling. Recycling of construction waste helps in saving the limited landfill space and save waste disposal costs. The energy required to reuse the recyclable materials is less that of virgin materials. It is an inert material which could be recycled and used many times without changing its chemical properties whereas use of recycled materials is the most attractive option in the field of construction today. Today, the interest of the construction community in using waste or recycled materials in concrete is increasing because of the sustainable construction, the waste glass from in and around the small shops is packed as a waste and disposed as landfill property. Besides using waste glass as cullet in glass manufacturing ,waste glass is also crushed into

specified sizes or fine powder for use in various application such as water filtration, grit plastering, sand cover for sport turf and sand replacement in concrete.

Also In the recent, various attempts and research are going on to use ground glass as its replacement in the ingredients of concrete production, which may be considered as a part of green house management .It is also observed that waste glass that is crushed and screened is a strong, safe and economical replacing cement by pozzolanic material like glass powder in concrete, not only increases the strength and introduces economy but also enhances the durability.

The effect of global warming has impacted everyone on the planet and is a wellrecognized concept. High levels of energy are needed to produce cement, which release large amounts of carbon dioxide (CO_2) and also contributes to the green house gases by substituting a portion of the Portland cement with glass powder greenhouse emissions are decreased. Fly ash and silica fume accomplish this as well but glass powder could be a cheaper alternative, since the demand in the concrete manufacturing is increasing day by day, the utilization of river sand as fine aggregate can also be minimized by the use of glass powder.

Fig. 1 Material Used For Study

II. Literature Review

1.Caijun and Keren et al; reviewed the three possible uses of waste glasses in production of cement and concrete, where their results can be summarized as follows: Firstly, the use of waste glasses as concrete aggregates has a slight negative effect on the workability, strength and freezing-thawing resistance of cement concrete. However, the main concern is expansion and cracking of the concrete containing glass aggregates. It needs to control the pH of the system below 12 in order to prevent potential corrosion of glass aggregates and expansion of the concrete, which may be achieved by the replacement of Portland cement with pozzolanic materials such as fly ash, silica fume and meta-kaolin. Secondly, waste glasses cans be used as raw materials for cement production as siliceous sources. However, it will increase the liquid content in the clinker, results in the formation of some Na compounds and increase in the alkali content in the cement. The effect will be dependent on the amount of waste glass used. If the percentage of waste glass used in the raw materials is low, the effects can be very minimal.

Finally, ground glass powders exhibit very good pozzolanic reactivity and can be used as cement replacement. As expected, its pozzolanic reactivity increases as its finesses increase. Alkalis in the glass powder can cause alkali-aggregate reaction and expansion if aggregates are alkali-reactive.

Results from ASTM C-1260 testing indicate that the alkali-aggregate reaction expansion decreases as glass replacement increases, and will be under the deleterious limit if the glass replacement is 50% or more. The combined use of other supplementary cementing materials such as coal fly ash, ground blast furnace slag and meta-kaolin can also decrease the expansion from alkali-aggregate reaction. Lithium salt can be a very effective additive to prevent the alkali-aggregate reaction expansion of concrete containing glass powders.

2.Dr G. Vijay Kumar et al; while studying on "Glass Powder as partial replacement of cement in concrete production" stated that finely powdered waste glasses was used as a partial replacement of cement in concrete and compared it with conventional concrete. This work examines the possibility of using Glass powder as a partial replacement of cement for new concrete. Glass powder was partially replaced as 10%, 20%, 30% and 40% and tested for its compressive, Tensile and flexural strength up to 60 days of age and were compared with those of conventional concrete from the results obtained, it is found that glass powder can be used as cement replacement material up to particle size less than 75um to prevent the alkali silica reaction.

Conventional concrete shows at 28 days compressive strength as 31.1N/mm², split tensile strength of 2.27N/mm² and flexural strength of 3.25N/mm². It was found that 40% replacement of cement with glass powder had gained 33.7% strength more than the conventional concrete. Split tensile strength was also

conducted which gave 4.4% increase in strength by 40% replacement of cement. Flexural strength of concrete was increased by 88.09%, 99.07% and 100% from the partial replacement of cement by 20%, 30% and 40% respectively.

Finally he had concluded that Glass powder concrete increases the compressive, tensile & flexural strength effectively, when compared with conventional concrete. Very finely ground has been shown to be excellent filler % may have sufficient pozzolanic properties to serve as partial cement replacement, the effect of ASR appear to be reduced with finer glasses, with replacement level.

3.N. Kumarappam et al; carried out experiment on "In partial replacement of cement in concrete using waste glass" and reviewed performance of concrete containing glass powder as partial substitution of cement. Portland Cement (PC) was partially replaced with 0-40% glass powder. Testing includes ultrasonic pulse velocity, compressive strength & absorption. Specimens where curved in water at 20° C results indicate that the maximum strength of concrete & finalize that there is a systematic increase in slump as the glass powder in mix increases the slump ranged from around 40mm for the reference (i.e.., 0% glass powder) to 160 mm at 40% glass powder. Using ground glass powder can reduce the use of cement and the associated energy demand impact of air pollution and Co2 emission. The slump of concrete seems to increase in glass powder in the concrete mix. At 10% of glass powder contains the compressive strength of concrete is higher than that of the control. Above 20% of Glass powder the strength substantially decreases.

4. J.M. Khatib et al; while studying on "Glass Powder Utilization in Concrete Production" stated that due to global warming the need to cut down energy applications. The main concerns for the use of crushed consumption have increased. The effect of global glasses as aggregates for Portland cement concrete are warming has impacted everyone on the planet and is a the expansion and cracking caused by the glass wellrecognized concept. High levels of energy are aggregates due to alkali silica reaction. Due its silica needed to produce cement, which releases large amounts content, ground glass is considered a pozzolanic material of carbon dioxide (CO2) and also contributes to the green and as such can exhibit properties similar to other house gases. The research paper was studied for glass powder as substitute to cement in concrete production, and the concrete was prepared by replacing cement by 10%,20%, 30%, &40% and was tested for its slump value, compressive test and ultrasonic pulse velocity and compared to the conventional concrete.

It was concluded that using ground glass powder can reduce the use of cement and the associated energy demand and impact on air pollution and CO emission. The slump of concrete seems to increase with the increase in glass powder in the concrete mix. At 10% glass powder content the of compressive strength of concrete is higher than that of the control. Above 20% glass powder the strength substantially decreases.

Objectives

The various objectives of our project are as follows

Silica	72.80%
Alumina	01.06%
Lime	08%
Iron oxide	0.36%
Magnesia	04.18%
Sodium oxide	13.10%
Potassium oxide	0.26%
Sulphur trioxide	0.18%

This above table shows the chemical properties of glass & from the above we conclude that the presence of silica in cement is the building property for the concrete. The strength of the concrete mainly depends upon the binding property of cement. In the glass silica is rich & when we use the glass in concrete. it increase the binding strength & hence automatically the strength of the concrete is increased.

1. To serve both as partial cement replacement & filler

Glass is unstable in the alkaline environment of concrete & could cause deterious alkali-silica reaction problems. This property has been used is advantage by grinding it into a fine glass powder (GLP) for incorporation into concrete on a pozzolanic material.

2. To use waste glass powder effectively by partially replacement the cement minimizing the environmental effects:

- To check its workability as green house decreases
- To minimize the environmental pollution.

4. To check the performance of concrete containing glass powder and compare it with conventional concrete:

The most important objective of this project is evaluate the recyclability of powered waste glass as a pozzolana as partial replacement of cement in concrete. And study the comparative effects of addition of powder glass, fly ash & silica fumes in concrete as pozzolana is mitigate alkali aggregate reaction.

5. To check the aesthetic appeal of the concrete:

The aesthetic appeal of the glass powder concrete is also checked whether it glass powder has any effects on the aesthetic appeal of the concrete derived.

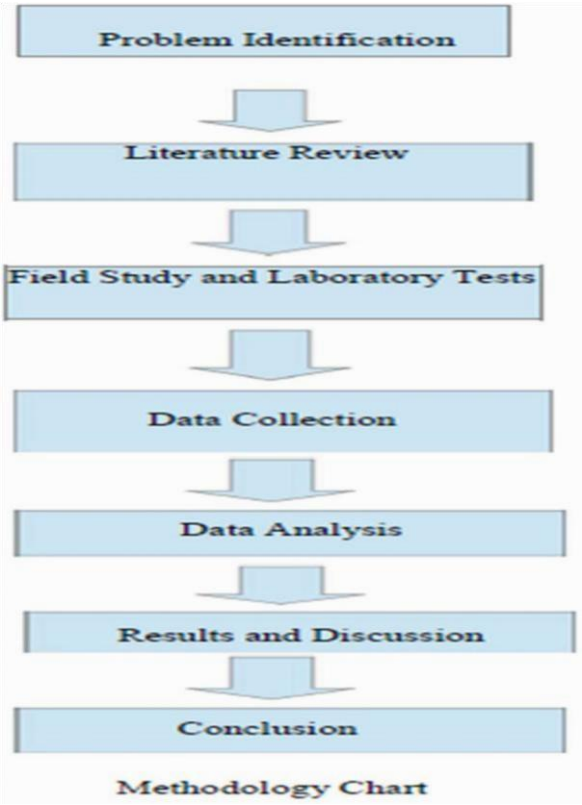
6. To increase the compressive and flexural strength effectively as compared with conventional concrete:

- To check its durability as an admixture.
- To check its effects on concrete as thermal insulator.

Recent research have shown that concrete made with recycled glass aggregate have shown better. Long term strength better thermal insulation due to its better thermal properties of the glass aggregates.

III. Methodology:

Methodology flow chart:



Methodology Chart

IV. CONCLUSION:

The following conclusions can be stressed from the affair of this exploration and can be epitomized as follows

➢ Waste glass greasepaint if plant finer shows pozzolanic gusted. Glass greasepaint exhibits pozzolanic parcels but is dependent upon fineness of the greasepaint.

➢ On addition of 20 glass greasepaint cosign the rate of gain of strength is low but at 28th day it meets needed design strength.

➢ At the position of 20 relief of cement by glass greasepaint meets maximum strength as compare to that of normal concrete and other chance of relief of cement.

➢ Addition of any quantum of glass greasepaint has shown reduction in water immersion of concrete.

➢ Base on the data from this design, the relief rate of 20 of glass greasepaint of size 355μμm has been recommended as the outside to achieve the profitable and environmental benefits without any inimical effect.

➢ The results attained from the present study shows that there's great eventuality for the application of stylish glass greasepaint in concrete as relief of cement.

➢ Glass greasepaint concrete increases the compressive, tensile and flexural strength effectively, when compared with conventional concrete.

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