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A Review Paper on Combined Effect of Waste Glass Powder and Plastic Fiber on the Properties of Concrete

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Abstract: ***Commonly glasses are used in construction and industries work and huge amount of glasses are powdered daily. Also the plastic's use increases day by day and PET (polyethylene terephthalate) bottle have increased become necessary part of a common man life. Waste glass and plastic disposal are an environmental issue. Due to waste glass powder & plastic face to disposal problem. Now a day's cost of construction is more with using basic material such as cement, sand and coarse aggregate. In this study 0%, 10%, 20%, 30%, and 40% cement is replaced by glass powder and sand is replacing by waste plastic fiber (like waste plastic bottle, plastic bags) with partially replacing sand by 1%, 2%, 3%, and 4% of plastic fiber and combined cement and sand are replaced by waste glass powder and fibers plastic such as above percentage respectively. All above proportional are mix design for M30 concrete and compare properties of concrete with without replacement of waste material concrete mix.***

Key Words: Powdered waste glass, waste plastic fiber, workability, compressive strength, flexural strength and cost comparison.

I. INTRODUCTION

For any construction in civil engineering concrete is a basic material. All basic ingredients which are used for concreting are natural. Concrete's properties can be change by adding some plasticizer and other material. Brittle material such as glass powder it is seen that compressive strength increases and fibers are also increase compressive strength and other properties.

Due to environment pollution and global warming pollution the need to cut down energy consumption increased. Global warming's has impacted everyone. In India due to domestic waste plastics and industrial glasses is considerable damage to the environmental and hence currently required to use of waste material for improving properties of concrete. Disposal of waste glass and plastic are an environmental issue. The use of plastic has increase continuously all over the word and it creates large quantities of plastic based waste. Various glasses waste and non biodegradable plastic waste is one of the big problems to dispose and manage as it is non biodegradable material which is harmful to environment and human life. PET bottle are mostly used as container for raw material, water, household cleaner and oil and are thrown after single usage. Disposed of PET bottle are treated by landfill and burning which create environment problem and create waste disposal and management issue. In this way use of glass are also big problem for creating environment problem. Huge amount of glass powder are produced by manufacturing of glass frame, glass windows, bulb, and glass bottle and after damage of these waste material disposal are big problem.

For reducing environmental impact of waste glass and plastic waste recycling is best method in concrete for increasing mechanical properties.

Hence this review paper addresses to reuse of waste glass in powder for as cement and plastic waste in their fiber like fine aggregates in concrete to obtained improved mechanical properties over traditional concrete and there by solve the disposal problem and management problem of glass waste powder and plastic waste.

II. REASERCH NEEDS

A. Due to issue related to limited natural resources like river sand and lime etc.
B. Disposal and management problem of non biodegradable waste material.
C. Improve concrete's properties over traditional concrete.
D. Increase flexural strength of concrete by using fiber form of plastic.
E. Reduce concrete's cost by using waste material.

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III. REVIEW OF LITERATURE

Y. M. choi et al. studied the polyethelene terephthalate bottle effect as a light weighted aggregate for compressive strength of concrete. water cement ratio kept in concrete were 45%, 49% and 53% and the replacement ratio of plastic were 0%, 25%, 50% and 75% by fine aggregate volume. The result was found after replacing of plastic decrease compressive strength of concrete with increase in plastic light weight aggregate but for a particular PET aggregate proportion, compressive strength increases with reduction in water cement ratio.

Raghatate Atul et al. In this paper plastic bags pieces are used for replacing sand and analysis it's for compression and tension properties of concrete cube. For preparing concrete mix, use OPC cement natural river as fine aggregate and place of coarse aggregate use granite stone and waste fiber plastic percentage were 0%, .2%, .4%, .6%, .8% and 1%. If we use fibers plastic bag pieces instant of cement in concrete than compressive strength of concrete reduced but tensile strength of increase with increase in plastic bottle pieces up to 0.8% and if replace more than 0.8% than tensile strength also decreases.

R. Kandasamy and R. Murugesan et al. In this literature, sand was replaced by polythene fiber and test for compressive and flexural bending strength of concrete. For testing concrete's grade was M20. Result was come after testing that compressive strength of concrete cubes increases up to .68% replacement.

Choi et al. Studied the change in density of concrete by using PET bottle as light weight aggregate. The proportion of concrete was mixed in such a way that the water/cement ratio was kept 45%, 49% and 53%. And the replaced ratio of waste light weight aggregate were 0%, 25%, 50% and 75% by volume of fine natural aggregate. As WPLA content increase, density of concrete mixture decrease. Mixture concrete's proportion were planned and obtained following result: (i) tensile properties of concrete decreased by 19%, 31%, and 54% with plastic bottle aggregates increase by 25%, 50%, and 75% respectively; and (ii) for a particular plastic bottle aggregate content, by reducing W/C ratio splitting tensile value of strength can be increase.

Frigione et al. Founds less values of splitting tensile value in concrete having PET aggregate mix using more w/c value and than in a same mix prepared at less w/c value. 5% sand is replaced by PET aggregate by weight, which is manufactured from PET bottle. Specimens were manufactured by using different w/c ratio and cement content.

This study shows the behavior of the concrete by using recycled plastic waste. In this work, 10% to 25% of plastic waste replaced as place of sand. For study M20 grade of concrete cube casted. After the testing of 28 days, it was seen that more plastic fiber decreases the strength. But the workability will be increased due to less absorbing water content by plastic.

Juglen Hiser et al. In this study, marble powder has replaced sand, the whole research is carried out on M60 grade with partially replacing sand by 0%, 15%, 30%, 45%, and 60% of marble dust, with addition of steel fibers at ratio 0.8% by volume so as to get greatest compressive strength, flexural strength and furthermore split tensile strength. Based upon the feasibility interpretation it is observed that replacing up to 45% marble powder and 0.8% of steel fibers in concrete is appropriate in conformance with the requirement. The compressive strength and the spilt tensile increased up to 15% replacement, after that they started decreasing.

Blate Sanjaykumar et al. In this studied cylindrical beam specimen with 1%, 1.5%, 2% fiber by volume, with .45% w/c ratio and compressive strength of 26 Mpa curing at 28 days. And he obtained workability of concrete was good enough up to addition of 1.5 to 2% of fiber. Also the bond strength will be increases with increase in fiber content.

Batayneh et al. Researcher has investigate that use of plastic waste to the slump value and compressive properties of concrete in varying proportional 0%, 5%, 10%, 15%, 20% and 25% as a fine aggregate at 0.56 w/C ratio. It was seen that slump value is decreased with increased plastic waste. Slump value is decreased due to plastic shape because edge of plastic is sharper than fine aggregate. And compressive strength is decreased with increased plastic waste. Reduction of strength was 23% with increase 5% plastic waste. Report was that plastic can be used in control way in concrete which is helpful for economical

Sager Bagde et al. In this work used plastic fiber as the instant of fine natural aggregate in varying proportional from 0% to 5%. Concrete grade was M20 and M30. All specimens are tested after 28^{th} days for compressive strength. Result is compared with normal concrete. By using fiber in concrete crakes arrested due to flexural properties of plastic. At the 3% plastic replacement compressive strength of concrete is minimum.

Dr. G. Vijayakumar et al. In this research glass powder is use instead of cement as 10%, 20%, 30%, and 40% and flexural, compressive, and tensile strength are tested. And compared with conventional concrete. He found that cement can be replaced by glass powder up to particle size less than 75 micron and increase strength.

Veena V. bhat et al. In this research, studied the behavior of concrete by using glasses powder such as 5%, 10%, 15% and 20% on place of cement and compared this concrete with without replacement glass powder concrete. He found that compressive strength of cube increase with increase use of cement like glass powder and decrease unit weight and porosity of concrete.

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Hongjian Du et al. In this work use of glasses powder for replacing cement in concrete. Proportion of glasses powder were 0%, 15%, 30%, 45%, and 60% by weight of cement. Result found that if the powder is used up to 30% then compressive strength was not decreased after 7 days and 28 days because pozzolanic reaction occur between cement and glass powder. But after 60% replacement compressive strength decrease.

Shajad ahmed et al. Study on concrete of M25 grade and use glass powder in varying proportion of 10%, 20%, 30% and 40% by weight of natural river sand and study on compressive strength. Split strength and durability and density test were perform after 28^{th} days of curing and it is compared with normal concrete of without replacement from result it can be seen that 20 replacement of glass powder causes 15% and 25% increase compressive strength at 7 days and 28 days of curing.

Shilpa raju et al. In this literature work for changing the concrete's strength by using of glass powder such as cement and find the behavior of concrete properties. Glass powder is increased in same Mainer. Concrete was mix designed for M20 and ratio of constituent of concrete was 1:2.35:4.17 with W/C ratio was 0.5 and cheeked for compression and flexural value. Glass powder is replaced from 5% to 40% with increase 5% continuously. Specimens are tested after 7^{th} days, 28^{th} days and 90^{th} days and compared with normal concrete. Alkalinity test was also done for finding resistance to corrosion. After all test it was found that higher strength obtained at the 20% replacement. And slump value decrease with increase glass powder.

Wand Her Yung et al. find the optimum quantities of glass powder with partial replacement by cement. Various specimens are prepared for different percentage of concrete and compressive test was done after 7 days and 28 days curing. And fined that glass powder give more strength when fineness is garter then 4500 cm^2/g. 10 % replaced glass powder give more strength.

Krati Gahoi et al. In this literature work M20 and M30 concrete grade is mix design to study. Glass powder replacement at the place of cement takes from 0% to 25 % with varying 5% percentage. Test is conduct after 3^{th} days, 7^{th} days and 28^{th} days for compression and flexural strength are cheeked after 28 days only. Glass powder used as pozzolanic material. For each replacement slump value, water absorption and density also measured. And result is that 10% replacement of glass gives more positive result. And concrete's strength cube decrease with increase glass powder and also water absorption.

Bhaat Nagar et al. In this literature replacement of cement by glass powder in varying proportional of 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, and 50%. Flexural, tensile strength are compared with conventional concrete. Mix design of concrete was M20 with 0.45 water ratio replacement. He found that flexural strength is increased 6% as compared to normal concrete and at 25% replacement tensile strength is improve 5.5%.

G. M. Sadiqual Islam et al. In this analysis concrete is mix designed for 35 Mpa. And cement has replaced by glass powder from 0 to 25% in 5% varying percentage. And specimens are tested after 7^{th}, 14^{th}, 28^{th}, 56^{th} and 90 days for compressive strength and chemical reaction. Replacement of 20% glass powder is economical as compare to cement and give more strength. 90 days compressive strength is slightly 2% more than conventional concrete.

IV. CONCLUSIONS

A. From various study it is clear that plastic fiber can be used as fine aggregate.
B. From various works on glass powder it is clear that glass powder can be used like cement in concrete.
C. Due to use of glass waste powder and plastics in concrete it can slow the impact of waste in environment.
D. Higher ratio of plastic fiber decreases concrete's strength. But increase workability of concrete mix.
E. By using waste material cost of concrete mix reduced.

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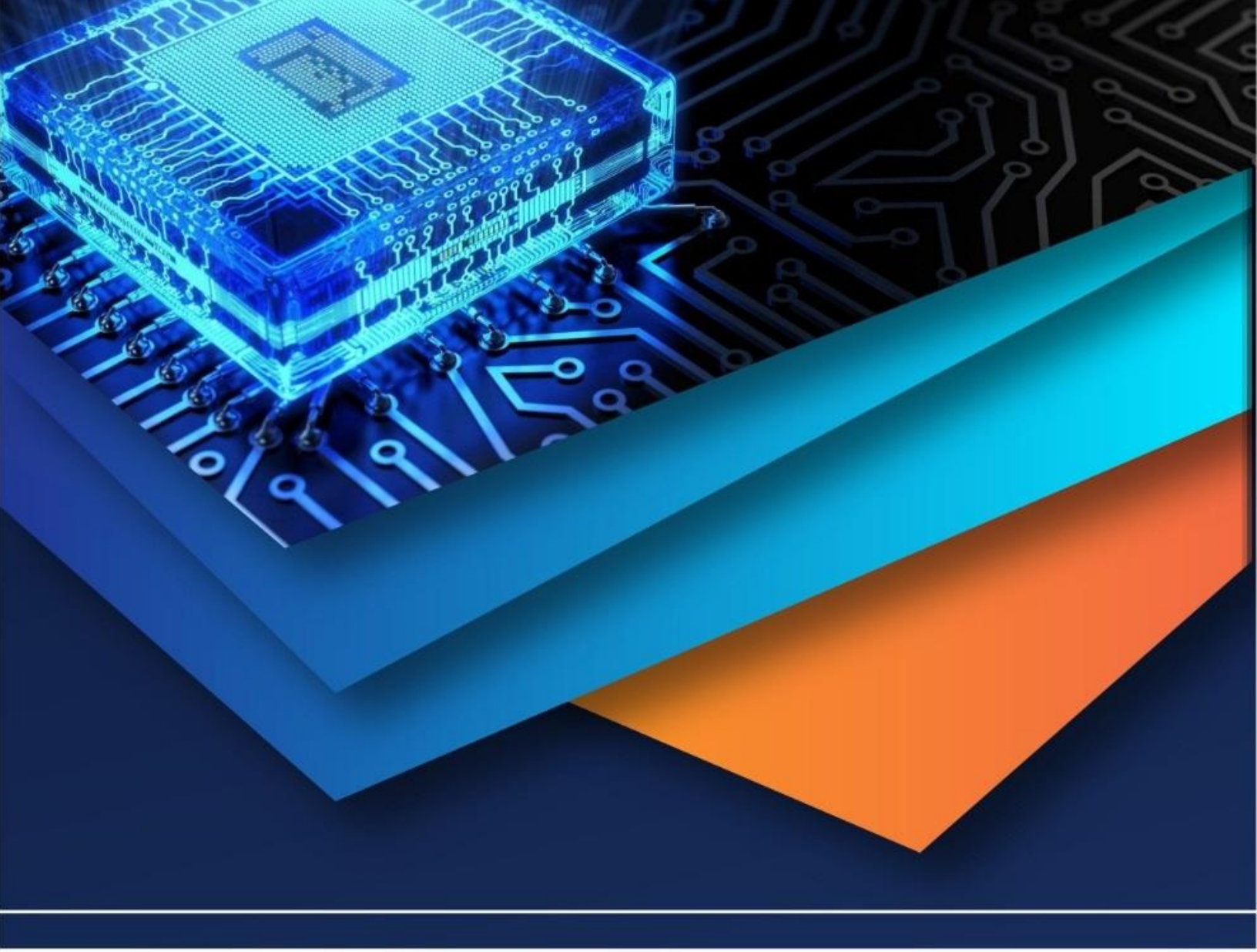
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