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A Review of Partial Replacement of Fine Aggregate & Coarse Aggregate by Waste Glass Powder & Coconut Shell

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Abstract - *The aim of the work is to study the suitability of glass powder & coconut shell, as a partial replacement of fine aggregate & coarse aggregate.*

Concrete is the mixture of various materials coarse aggregate, fine aggregate, cement & water, each of them is mixed in various proportions to achieve specific strength. Cement being the most important material plays an important role in the manufacturing of concrete. Waste glass in the form of fine aggregate & coconut shell as coarse aggregate can be used. Researchers has investigated that glass posses a pozzolana properties due to increase in silica content, so it can be replace fine aggregate to some degree and can improve the strength and also increase the durability of concrete.

The chemical compositions of coconut shell taken under study are almost similar to that of ordinary cement. In this experiment, work coconut shell plays a major role as it is used as coarse aggregate in all the combination of concrete cube. The proportion of the mineral and mixtures is applied in testing cubes for their workability, compression strength and flexural strength.

Key Words: **Concrete, waste glass powder, coconut shell, partial replacement, fine aggregate, coarse aggregate.**

1. INTRODUCTION

Concrete is the second largest of widely used material; but there are environmental issues related with its use which are needed to be taken under considerations. 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. Use of natural aggregates at a great rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal causes environmental concern. In civil engineering construction, using alternative materials in place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material. Coconut shell being a hard and not easily degrade material if crushed to size of sand can be a potential material to substitute sand. At present time, coconut shells are also been burnt to produce charcoal and activated carbon for food and filtering mineral water use. However, the coconut shells are still under utilized in some places. The chemical composition of the coconut shell is similar to wood.

2. LITERATURE REVIEW

[1] Rakesh Sakale et. al (2015) studied the replacement of fine aggregate by waste glass powder in steps of 10%, 20%, 30% and 40% respectively by volume of cement and its effects on compressive strength, split tensile strength, workability and flexural strength are determined. It is found that the compressive, flexural and split tensile strengths of concrete increase initially as glass powder increases and become maximum at about 20% and later decrease. The workability of concrete reduces monotonically as the replacement percentage increases. The replacement of cement up to about 20% by glass powder can be done without sacrificing the compressive strength.

[2]Chikhalikar S.M. and Tande S.N(2012) There is a need to replace a part of fine aggregate by waste glass powder to reduce the consumption of fine aggregate and the environmental pollution can be checked to some extent. Recently the research has shown that the waste glass can be effectively used in concrete as fine aggregate. Waste glass when grounded to a very fine powder shows some cementitious properties because of silica content. Therefore the glass powder to some extent can replace the cement and fine aggregate, contributes for the strength development and also enhances durability of the concrete.

[3]VeenaV. Bhat, N.BhavanishankarRao(2014) Glass is an indeterminate material with high silica content (SiO2) 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.

[4]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. According to previous studies, all the applications, which require pre-conditioning and crushing of waste glass, are more or less limited and unable to absorb all the quantities of waste glass available. 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.

[5]R. Vadhiyan et al (2013) when glass powder is added as a fine aggregate; it provides a large volume of hydration products. The added glass provider in concrete changes the concrete paste structure. The resulting paste contains more of the strong calcium silicate hydrate (CS-H) & less of the weak & easily hydroxides $(CaOH)_2$, than conventional cement paste.

[6]Vasudevan Gunalaan and Kanapathy pillay Seri Ganis (2013) Investigated the test results at 7, 14, 28 days of curing of specimens containing waste glass powder as partial replacement of fine aggregate and his results showed that the 20% of glass powder mix amount shows a positive value of compressive strength at 28 days compare to other ratio which 10% and 15% is not achievable even though have very little increment for 14 days results.

[7]Dali J.S. and Tande S.N. (2012) studied the properties of concrete containing mineral admixtures. When it is subjected to alternative wetting and drying showed that 20% replacement of fine aggregate with glass powder gives higher strength in both the cases when concrete not subjected to alternative wetting and drying, and when concrete subjected to alternative wetting and drying.

[8]Sunny O. and Poutos Konstantinos I. (2013) in their research on the influence of Waste Glass Powder on the Properties of concrete presented that Water absorption increases with increase in glass powder content.

[9]J.P. RIES (2015) Lightweight aggregate (LWA) plays important role in development of today's sustainable concrete. Lightweight aggregates contributes to sustainable development by lowering transportation requirements, optimizing structural efficiency that results in a reduction in the amount of overall building material being used, conserving energy, Reducing labour demands & overall cost and increasing the survive life of structural concrete

[10]VISHWAS P. KULKARNI (2013) studied that aggregates provide volume at low cost, comprising 66 percent to 78 percent of the concrete. Conventional coarse aggregate namely gravel and fine aggregate is sand in concrete will be used as control. While natural material coconut shell as course aggregate will be investigate to replace the aggregate in concrete.

[11]AMARNATH YERRMALLA (2012) The strength of coconut shells (CS) when replaced by coarse aggregate and then, when studied transport properties of concrete with coconut shells (CS) as coarse aggregate replacement. He concluded that an increase in coconut shells (CS) percentage decreased densities of the concrete and with coconut shells (CS) percentage was increased in the 7 days curing strength and is also increased with corresponding 28 days curing strength.

[12]Parag S.Kambli & Sandhya R.Mathapati. (2014) prepared three different Mix Designs for M20, M35, M50 grades of concrete. Percentage replacement by coconut shell varied as 0%, 10%, 20%, 30%, 40% respectively. It is concluded in this study that for M20 grade concrete cubes with 30% replacement of CS aggregates had given strength of 23 MPa at 28 days. Concrete cubes with 30% replacement of CS aggregates had given strength of 42 MPa at 28 days for M35. For M50 grade concrete cubes with 30% replacement of Coconut Shell aggregates had given strength of 51 MPa at 28 days.

[13]Damre Shraddha and Shrikant Varpe (2014) replaced conventional coarse aggregate with coconut shell and concluded that- with 50% replacement of coarse aggregates by coconut shells, the strength attained reduces invariably from 10%-20% as compared to the conventional coarse aggregate concrete. With 50% replacement of coarse aggregates by coconut shells, the flexural strength attained reduces invariably from 10%-15% as compared to the coarse aggregate concrete.

[14]Maninder Kaur & Manpreet Kaur (2012) published a review paper in which it is concluded that use of coconut shells in cement concrete can help in waste reduction and pollution reduction. It is also expected to serve the purpose of encouraging housing developers in investing these materials in house construction. It is also concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

[15]Abdulfatah and Saleh (2011) conducted experiments to determine the suitability of coconut shell as full replacement for coarse aggregate in concrete works. A total of 72 concrete cubes of size 150×150×150 mm with different mix ratios of 1:2:4, 1:1.5:3 and 1:3:6 were casted, tested and their physical and mechanical properties were determined. Compressive strengths comparable to that of plain concrete were observed. The study concluded that cost of producing concrete can be reduced up to 48%.

[16]Amarnath and Ramachandrudu (2012) studied the effect of fly ash on concrete with coarse aggregate partially replaced with coconut shell aggregate. It was observed that coarse aggregate replaced with equivalent weight of fly ash

had no influence when compared to the properties of corresponding coconut shell replaced concrete.

[17] Daniel Yaw Osei (2013) used a concrete mix of 1:2:4 as control concrete, while coconut shells were used to replace crushed granite by volume. The density and compressive strength of concrete were found to reduce as the percentage replacement increased. Concrete produced with 20%, 30%, 40%, 50% and 100% replacement attained 28-day compressive strengths of 19.7 N/mm2 , 18.68 N/mm2 , 17.57 N/mm2 , 16.65 N/mm2 and 9.29 N/mm2 corresponding to 94%, 89%, 85%,79.6% and 44.4% of the compressive strength of the control concrete. The study recommended that concrete produced by replacing 18.5% of the crushed granite with coconut shell aggregate can be economically used in reinforced concrete.

3. CONCLUSIONS

From the above mentioned work of assorted researchers, it's clear that waste glass powder & coconut shell is used as a partial replacement of fine aggregate & coarse aggregate in concrete due to its enhanced workability, strength parameters like compressive strength and flexural strength and also due to its enhanced durability measured by density check and water absorption check.

A. In comparison of waste glass powder & coconut shell concrete itself, in between 35%, 45%, 55% the strength is achieved in 35%.
B. To comparison of conventional concrete to the waste glass powder & coconut shell concrete the strength of the waste glass powder & coconut shell concrete not attained target strength.
C. The application of waste glass powder & coconut shell concrete to flooring concrete and surface coatings. etc.
D. This project suggests reduction in amount of fine aggregate & coarse aggregate.
E. On one hand the waste disposal problem is solved and on other hand the waste glass powder & coconut shell is gainfully utilized.
F. In our location the coconut shell waste glass powder & concrete is not use for structural elements but we used for non structural elements

As disposal of waste by-products drawback could be a major problem in today's world because of restricted landfill area , escalating costs for disposal, utilization of waste glass concrete won't solely offer economy, it'll conjointly facilitate in reducing disposal issues.

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