

PARTIAL REPLACEMENT OF AGGREGATES WITH COCONUT SHELL IN CONCRETE: A REVIEW

Ankur Singh¹, Faheem Ahmad Khan², Bilal Siddiqui³

¹Post Graduation Student, Department of Civil Engineering, B.B.D University, Lucknow (UP), India

²Assistant Professor, Department of Civil Engineering, B.B.D University, Lucknow (UP), India

³Assistant Professor, Department of Civil Engineering, B.B.D University, Lucknow (UP), India

Abstract - Diverse waste materials, for example, fly ash, silica fumes, copper slag, devastated concrete has been effectively utilized to create different materials for building development, for example, concrete, flush doors, plywood and so forth. Aggregate is a noteworthy element for influencing concrete, to involve right around 70-80% of cement. Traditionally pulverized rocks are utilized as coarse aggregate and river sand as fine aggregate. Both are naturally accessible material. Because of quick development of construction exercises, traditional aggregates sources are exhausting quick prompting noteworthy increment in expense of construction. For sustained development, these materials ought to be utilized carefully and elective materials should be sought to supplant conventional aggregates. Expansive number of studies has been done to scan elective materials for generation of concrete. In the meantime because of quick industrialization, generation of waste material is expanding continuously. Its disposal has turned out to be a genuine issue. Answer for this issue is to get rid of it by landfilling on site or utilize this waste for some positive activity. Space for landfill site is winding up expense issues. In perspective of this the alternative is it is possible that we ought to limit the waste at production level, or use it. India is the third biggest coconut creating nation on the planet. Ample measure of waste is created by coconut. The waste coconut shell might be utilized to supplant traditional coarse aggregate. The point of this paper is to deliver issue related to scarcity of conventional material, issues of disposal of waste material and assess the works done on utilization of waste coconut shell for production of concrete.

Key words : Admixtures, coarse, aggregates, coconut shell, waste disposal.

1. INTRODUCTION

Concrete is a composite material which made out of aggregates, cement and water. Concrete is utilized more than some other human made material on the planet. What's more, concrete is the second most devoured substance on the planet behind water. Around 7.23 billion tons of concrete is created each year. Yearly production speaks to one ton for each individual on the planet. Generation of concrete is expanding because of high infrastructural advancement and construction practices on the planet. Creation of concrete demands its constituents like aggregate, cement, water and admixtures. The huge scale creation of concrete in construction practices utilizing conventional coarse aggregates, for example, granite radically decreases the natural stone deposits and influencing the earth consequently causing environmental imbalances. Ever increasing demands of natural occurring aggregates demonstrate that crushed stone demand will be 2050 million metric tons in 2020. This enormous demand of regular total brings up a significant issue about protection of conventional aggregates hotspots for sustainable development. Extraction and processing of aggregates is likewise a noteworthy issue for the environment. In this way utilization of elective waste material instead of regular aggregates in concrete generation secures environment as well as makes concrete a feasible and environment amicable material for construction. Distinctive waste material like rubber, fly ash, glass and so on has been utilized as option for supplanting conventional aggregates. Aside from the above

mentioned waste materials, a couple of studies demonstrates that agricultural waste coconut shell can likewise be utilized as coarse aggregate for cement.

2. Coconut Shell

Coconut is produced in more than 93 nations. India is the third biggest, having cultivation on an area of around 1.78 million hectares for coconut production. Yearly generation is around 7562 million nuts with a normal of 4248 nuts for each hectare. The coconut industry in India represents over a fourth of the world's aggregate coconut oil yield and is set for further growth with the worldwide increment in demand. However, it also adds to the nation's pollution problems as solid wastes which includes a yearly generation of around 3.18 million tons. It additionally introduces disposal issues for the environment, is a plentiful available farm waste from nearby coconut industries. In developed nations, where plentiful coconut shell waste is released, these wastes can be utilized as potential material or

substitution material in the construction activities. This will have the twofold favourable position of decrease in the expenses of construction material and furthermore as a method for waste disposal.

3. Properties of coconut shell

1. It has low cellulose content because of which it ingests less dampness in contrast with other agriculture based waste materials.
2. Coconut shell has high strength and modulus properties.
3. Coconuts being accessible in nature and since its shells are non-biodegradable, they can be utilized promptly in concrete which may satisfy every property of conventional aggregate based concrete.
4. Composites are more weather resistant due to high level of lignin content.

4. Coconut shell as an option to coarse aggregate

In perspective of push on energy conservation and sustained development, the utilization of alternate constituents of natural resources and the search of appropriate option in contrast to conventional construction material is presently a worldwide concern. To make utilization of alternative aggregate in concrete which is coconut shell has never been a typical practice among the general population, especially in territories where light weight concrete is required for non-load bearing dividers and non-structural floors.

Concrete acquired utilizing coconut shell as a coarse aggregate fulfil the basic prerequisites of concrete. Coconut shell aggregate resulted in worthy strength which is required for structural concrete. Coconut shell may introduce itself as a potential material in the field of construction industry. The coconut shell is compatible with cement and no compelling reason to pre-treatment for utilizing it as coarse aggregate. Due to the smooth surface on one side of the shells concrete made with coconut shell presents better workability. The presence of sugar in the coconut shell, does not influence the setting and quality of concrete since it isn't in a free sugar form. It is discovered that wood based materials being hard and of organic origin, won't pollute or filter to create poisonous substances once they are bound in concrete grid.

5. Research investigations

Shortage of conventional resources and coconut shell squander disposal issues made the various researchers to examine and investigate the possibility of use it for construction tasks. A couple of studies are done on coconut shells and the results of the investigations are as follows:-

Manindar Kaur and Manpreet Kaur (2012) In this research paper it is presumed that utilization of coconut shells in cement concrete can help in waste reduction thereby reducing pollution. It is additionally anticipated that would effectively encourage building developers in putting these materials in construction. It is concluded that the coconut shells are more appropriate as low strength giving lightweight aggregate when used to supplant conventional coarse aggregate in concrete production.

Daniel Yaw Osei (2013) In this research paper coarse aggregate is partially supplanted by coconut shell. Rates of substitution by coconut shell were – 0%, 20%, 30%, 40%, 50%, and 100%. The conclusion made at the end is that coconut shell can be utilized to create lightweight concrete. 18.5% supplanting of pulverized granite with coconut shells can be utilized to produce concrete.

Damre Shraddha and Shrikant Varpe (2014) In this research paper conventional coarse aggregate is supplanted with coconut shell and presumed that-with 50% substitution of coarse aggregate by coconut shells, the strength achieved lowers constantly from 10%-20% when contrasted with the regular coarse aggregate. With half substitution of coarse aggregate by coconut shells, the flexural strength achieved decreases constantly from 10%-15% when contrasted with the coarse aggregate concrete.

Vishwas Kulkarni (2013) In this research paper it was examined that aggregates give volume at low pricing, containing 66 percent to 78 percent of the concrete. M20 concrete is produced by 0%, 10%, 20%, 30% substitution of coarse aggregate by coconut shell. There is no compelling reason to treat the coconut shell before use as an aggregate with the exception of water ingestion. No bond failure was noticed, affirming that there was satisfactory bonding between the coconut shell aggregate concrete and the steel bars.

Siti Aminah Bt Tukiman and Sabaruddin Bin Mohd (2009) In this research paper coarse aggregate was supplanted by coconut shell and grained palm kernel. Level of substitution by coconut shell were 0%, 25%, 50%, 75% and 100%. Conclusion was made that the mix of these materials has capability of being utilized as lightweight aggregate in concrete and furthermore has reduced the material expense in construction.

Tomas U. Ganiron Jr (2013) In this research paper coconut shells and fibre were utilized as substitute for aggregates in creating hollow concrete blocks. The examination was completed for different percentages of coconut shell content as

partial substitution of conventional aggregate. Results demonstrated that appropriate substitution of coconut shell produces functional concrete with agreeable strength thereby improving the quality of concrete.

Dewanshu Ahlawat and L.G.Kalurkar (2014) In this research paper it is investigated the likelihood of producing M20 concrete by supplanting conventional aggregate by coconut shell. Forty-five solid cubes were cast. Percentage substitution of conventional coarse aggregate by coconut shell were 2.5%, 5%, 7.5%, 10%. Compressive strength was 19.71, 19.53, 19.08, 18.91 N/mm² at 28 days. Workability and compressive strength had been assessed at 7, 14 and 28 days. The compressive strength of concreted lessened as the rate substitution expanded. By these outcomes it may be presumed that coconut shell concrete can be utilized in reinforced concrete construction and also cost effective and eco-friendly at the same time.

Amarnath Yerramala Ramachandrudu(2012) In this research paper, coarse aggregate was partially supplanted by coconut shell and fly ash. Rates of substitution by coconut shell were 10%, 15%, 20% and rates of coconut shell substitution by fly ash were 5%, 25%. It was concluded in the investigation that the workability lowered with increment in coconut shell substitution. Compressive and split tensile strength of coconut shell concrete were lower than conventional concrete [11].

Gopal Charan Behera, Ranjan Kumar Behera In this research paper the relative cost investigation and strength attributes of concrete created utilizing coconut shell as substitutes for conventional coarse aggregates has been done. The principle objective was to support the utilization of coconut shell as construction materials in low cost construction.

J. P. Ries (2011) In this research paper it is observed that the light-weight aggregate plays imperative role in the present move towards sustainable concrete. Lightweight aggregate plays an important role towards sustained development by bringing down transportation requirements, upgrading structural efficiency that outcomes in a decrease in the measure of overall building material being utilized, preserving energy, diminishing demand of labour and expanding the life of concrete.

6. CONCLUSION

This review centres around generation of concrete utilizing farming waste for supplanting quick exhausting conventional aggregates sources and there by finding the answer for social and environmental issues. At present, the increasing expense of building materials is the factor of concern. The provocation of making a lightweight concrete is diminishing the density while keeping up strength and without unfavourably influencing costing.

- From the test results and deliberations of above researches on coconut shell, the coconut shell has potential as lightweight aggregate in concrete. Additionally, utilizing the coconut shell as aggregate in cement can lessen the material expense in view of its very low cost and abundant availability.
- Coconut shell has poses more resistance against pounding and abrasion when contrasted with granite rock. There is no compelling reason to treat the coconut shell before use as aggregate with the exception of water absorption.
- These examinations also acknowledge utilizing coconut shells and fibre as substitute for aggregates in casting hollow square blocks.
- From the above reviewed paper it is found that the increase of coconut shell diminishes workability and expansion of fly ash either as cement substitution or aggregate substitution increases workability of coconut shell concrete. We can likewise utilize fly ash to enhance workability of coconut shell concrete.
- While using coconut shell as aggregate in concrete production the amount of cement content may be more.

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