

# Coconut: A Review on a Plentiful Farming Produce

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**Abstract-** As there is an economic boom there is an increasing demand for infrastructure in order to accommodate the requirement. As this will lead to high demand for natural construction material and this will deplete them quickly. This paper has been presented in order to give the developers an insight about the usage of alternate material and how it make the whole project structurally and economically feasible. A number of literatures has been reviewed and ultimately the coconut shell has been highlighted for a variety of function such as landfill, light weight concrete and structural concrete. This paper contains a thorough investigation on the application of coconut shell in structural concrete with the percentage of replacement of coconut shell as partially so that natural aggregates usage can be minimized. The experiment has been done in this project has considered 7 days and 28 compressive strength of concrete with no replacement 5%, 10%, 15%, 20% and 25%. The coconut shells are widely available natural material and can be helpful to contribute to the sustainability of the construction.

**Key Words-** Coconut shell, Concrete, Sand Aggregate

## I. INTRODUCTION

Nowadays, solid waste management is being thought of as a grave concern in India because of a massive population, because of major issue. because the results of that an enormous pile of waste generated, a number of the causes are increase in population, healthiness and ever-changing lifestyles in India, the environmental restrictions are enacted including the strict management of waste disposal sites, resource restrictions and accenting the awareness of the general public regarding the depletion of natural resources, and therefore the long run impact of temperature change caused by global warming. Annual production represents close to 1.5 ton for each person on the world.

Aggregates are the biggest constituent within the concrete. Regarding 70–80% of the degree of structural concrete is occupied by aggregates, within which 25–30% is occupied by fine combination and 40–50% is occupied by coarse combination. Amount and properties of coarse combination has hefty impact on varied characteristics and properties of concrete.

Generally, rocks which had been crushed are used as aggregates along with river sand. Because of rise of construction activities, standard combination sources are depleting in no time resulted in inadequacy of resources. For property development, these materials ought to be used sagely and at a similar time different materials have to be compelled to be searched to interchange standard combination. Besides, these crushed aggregates could contain a proportion of irrespirable crystalline silicon dioxide or free silicon dioxide that releases throughout the assembly and handling and will cause health issues or skin irritation.

### 1. Coconut Shell as A Alternative Coarse Aggregate

In perspective on push on vitality sparing and maintainable advancement, the utilization of elective constituents of common assets and the hunt of appropriate option in contrast to regular development material is currently a worldwide concern. To utilize elective total in solid which is coconut shell has never been a typical practice among the general population, especially in zones where light weight concrete is required for non-load bearing dividers and non-basic floors.

Concrete acquired utilizing coconut shell as a coarse total fulfils the base prerequisites of cement. Coconut shell total came about adequate quality which is required for auxiliary cement. Coconut shell may introduce itself as a potential material in the field of development businesses. The coconut shell is good with concrete and no compelling reason to pre-treatment for utilizing it as coarse total. In light of the smooth surface on onside of the shells concrete made with coconut shell exhibits better usefulness.

Coconut shell solid shows great effect opposition. At the point when appeared differently in relation to customary complete water immersing and moistness holding cut-off of coconut shell is more. The proximity of sugar in the coconut shell, does not impact the setting and nature of concrete since it isn't in a free sugar structure. It is discovered that wood based materials being hard and of natural starting point, won't taint or filter to create dangerous substances once they are bound in solid lattice.

## II. RESEARCH FINDINGS

Shortage of customary assets and coconut shell squander transfer issues made the looks into to examine and investigate the likelihood of use it for construction activities. A few studies are done on coconut shells and the outcomes of the researches are as following:-

**K. Gunasekaran et al** in 2016 published a paper that deals with the comparative study of the concrete pipe with shell replaced aggregates concrete pipes. There were numerous test performed on both the specimen specified by IS 458:2003. Both of them were having load bearing capacity with the acceptable limits as prescribed by the code mentioned earlier. The hydro-static pressure didn't form beads of water on the pipe surface by application of test pressure of 0.07 N/mm<sup>2</sup>. Absorption properties of shell replaced aggregates pipes and conventional pipes were also within limits acceptable by code. Since the performance was of shell replaced aggregates of pipes were satisfactory, the paper concludes that it can be used as an alternative material for conventional aggregates.

**Sarfraj Jahagirdar et al** in 2016 published a paper in which study was conducted to compare the standard M20 cube strength with coconut shell aggregates as partial replacement for the quarry aggregates. The study has casted cubes of 10-12mm coconut aggregates along with same size quarry aggregates. The partial replacement of 20%, 30%, 40%, 50% and 60% were performed respectively. A total of 36 cubes were casted and the 7 days compressive strength (in MPa) were 20.89, 16.89, 16, 14.74, 10.67 and 9.19 for the respective percentage of replacement mentioned previously and 28 days strength (in MPa) of 24.89, 19.85, 18.07, 16.37, 13.78, 12.74 respectively.

**A. Anbuvel et al** in 2016 published a paper that examines the variety of properties of coconut shells as aggregate replacement. A concrete sample with Natural aggregate replacement of 0-20% was provided. There were two design mix i.e. fly ash and coconut shell that were investigated for properties such as water absorption, compressive strength, moisture content and split tensile strength. It was reported that as % shell increases density decreases. Workability also decreases. Both the compressive strength and split tensile strength also decreases. The permeable voids and absorption were recorded more than the sample with conventional aggregate. Fly-ash replacement had no notable effect. Hymns were casted and tested on the basis of their flexural strength and compressive strength and the results were reported. It was found that as we increase the percentage coconut shell the density, compressive strength and flexural strength decreases.

**Apeksha Kanojia et al** in 2015 published a paper that reviews a variety of waste material such as silica fumes, copper slag, fly ash etc. These are mainly used as primary ingredients to make plywood, flush door etc. For the

concrete the main ingredients is aggregate which covers 70%-80% as its constituents. The growth on construction industry is greatly reducing the available natural resources, hence the papers shows that by applying these waste material to the main constituents of the concrete as partial replacement in order to economize the whole project cost.

**Amrita Agnihotri et al** in 2015 published a paper that reflects concerns towards the increasing prices of building materials and its effect on increasing prices of house in the world. The paper deals with comparative study of conventional aggregate and granular coconut as partial replacement for aggregate in casted beams with respect to their flexural and compressive strength for M20 grade of concrete. There were little difference in the properties but huge difference in the cost and hence it suggested the developers to encourage the alternative materials.

**Miss. Anjali S. Kattire et al** in 2015 published a paper where they studied a total of 16 specimen casted 8 cubes and 8 cylinders and their compressive and tensile strength were measured after 28 days. Coconut shell was used as a partial replacement and the percentage at which it was replaced were 0%, 10%, 15% and 20% respectively. Although with increasing replacement the above mentioned mechanical properties started to show decrement, some of them were still good for construction of light weight members.

**Lopa M. Shinde et al** in 2015 published a paper that reviews the practical application of the agricultural waste as replacements for construction materials in order to lower down the cost of construction. It is also recommended to promote sustainable development of the structure in order to lower the impact on the environment. It highly issues the concern about recycling the material in order to lower the burden on natural resources. The papers describes how increasing utility of agricultural waste not only decreases pollution but also decreases the cost of construction. This has been shown by testing coconut shell as aggregate partial replacement from a wide range literature review.

**Chandraul Kirti et al** in 2015 published a paper that deals with researching the concrete for a design mix of 1:1.51:3.06 as a control sample and crushed coconut shells were used as replacement for crushed granite aggregates. Overall 36 cubes were casted with water / cement ratio as 0.5. The coconut replacement that was used in study were 10%, 20%, 40%, 60%, 80% and 100%. As we increase the percentage of coconut shell the density decreases. There is a bright side that the 20% replacement can be used widely in construction and can be a viable replacement for natural sourced aggregates thereby decreasing the cost of construction and burden on natural resources.

**Shamjith K M et al** in 2015 published a paper that mentions that as Natural River sand and coarse aggregate

are being depleted there is an urgent requirement to look for some alternative material. The viable option was chosen as coconut shell as replacement for aggregates and then the study was conducted with partial replacement of coarse aggregate with coconut shell as 5%, 10%, 15%, 20%, 25%, 30% and 35%. The water / cement ratio is 0.5. There were a total of 24 cubes, 21 cylinder and 21 beams altogether tested and it was found that coconut shell aggregates with 15% replacement were having properties comparable to that of conventional materials.

**Parag S. Kambli et al** in 2014 published a paper that deals with the alternative source of replacement of concrete aggregates. There is a poor management of materials resulting in excessive wastage and poor quality of construction with a high construction cost. The study focuses on three grades namely M20, M35 and M50 with six samples for each mix and the percentage of replacement of coconut shell that was used are 0%, 10%, 20%, 30% and 40%. The 7 and 28 days strength were tested and found that aggregate replacement upto 20% is feasible to be used in construction. Additionally replacement of aggregates lowers the cost of construction.

**Pravin V. Khandvel et al** in 2014 presented a paper in which he suggested that the vital ingredient of the concrete is coarse aggregate. Nowadays, several of the researchers are researching the material which might cut back the value of construction likewise as increase the value. In developing countries, the chance of using some agricultural wastes likewise as industrial by-products from totally different industries as construction materials are going to be desirable and has been found to own many sensible things. It had been ascertained that the coconut shell includes a nice potential as a partial replacement of the mixture within the concrete. The current work is just associate degree accumulation of data regarding GFRGC and therefore the research work that is already administered by different researchers.

**Damre Shraddha et al** in 2014 presented a that deals with the study of the sustainable buildings over a wide range of parameters such as carbon emission, materials used and water use. It also concerns on the involvement of economic feasibility, environmental health and social equity in it. The papers keeps stressing on the point of using recyclable materials such as coconut shells which is a agricultural waste in order to provide new vision to contractors and developers in construction materials. It can be used in housing construction as an ingredient for concrete. It can also be used as landfills and if approved by government of India it can drastically decrease the cost of construction.

**Daniel Yaw Osei et al** in 2013 presented a paper that paper concerns with the study of M20 concrete with

partial replacement of aggregate with coconut shell in an increasing fashion which is 20%, 30%, 40% and 50% and 100% and the 7 day compressive strength were found out to be  $19.7 \text{ Nmm}^{-2}$ ,  $18.68 \text{ Nmm}^{-2}$ ,  $17.57 \text{ Nmm}^{-2}$ ,  $16.65 \text{ Nmm}^{-2}$  and  $9.29 \text{ Nmm}^{-2}$ . This shows that concrete replaced by 20% gives the closest value to desired value. Hence it could be used as an alternative to concrete used in structural members as well as lightweight materials.

**Tomas U. Ganiron Jr et al** in 2013 presented a paper that addresses a great deal of stress given on using alternative material in construction industry in order to reduce burden on the natural resources. The study tested the hollow concrete blocks with coconut shell fibers as substitute for aggregates. The workability test were conducted on the basis of ASTM136 and ASTM 137. Compressive strength were also conducted. It was discovered that these substitution were workable as well as gives satisfactory strength.

**Maninder Kaur et al** in 2012 presented a paper in which she studied the employment of coconut shell as a rough combination has been mentioned supported the results obtained from comprehensive review of literature. We tend to all wish that our buildings should be sturdy and will build with the development material of affordable rates. Each industry altogether depends on cement, sand and aggregates for the assembly of concrete. Nowadays, most of the analyzers do the research on the fabric which might cut back the value of construction also as increase the strength. A number of the waste materials are utilized in concrete per their properties.

For example waste material like ash from power plant, rice, and sludge from sewage after treatment can be used as an alternative for aggregate in concrete. The coconut shell could be a material which might be a substitute for aggregates. The shell of the coconut is generally used as an ornament and as a supply of carbon. The pulverized shell is additionally utilized in the industries of plastics, glues, and abrasive materials. The utilization of coconut shells conjointly can facilitate the interference of the setting and also facilitate economically. Sun drying shell ought to be wont to check that perishable materials decay before its commixture with concrete. It additionally contributes to property construction. The aim of this paper is to unfold awareness concerning the employment of coconut shell as a construction material in civil engineering.

**Amarnath Yerramala et al** in 2012 presented a paper to demonstrate on the how coconut shells can be partially replaced as conventional aggregates. The study has replaced 10% to 20% aggregates with coconut shell with 5% increment and a constant water/cement ratio of 0.6. The density of concrete decreases as we increase

coconut shell percentage as well as compressive strength. Absorption percentage and permeable voids were also higher than the conventional samples.

**P.S. Kumar et al** in 2012 that deals with the long term performance of coconut shell as aggregate concrete which has been studied under scanning electron microscope (SEM) in order to determine the pore structure of the concrete. It was found that the pore structure acts as a reservoir and continuous curing produced highest strength in concrete. The biological decay was not seen in the sample even after 365 days. Till the age of 90 days all the sample shows improvement in pulse velocity with a minor drop. The ultimate bond strength appears to be good between cement paste and coconut shell as SEM shows that with time the fissure between them narrows down with time.

### III. CONCLUSIONS

This main point of this review is on production of concrete using waste material as a key point of using this ingredients in replacing fast depleting conventional aggregate sources as construction material and thereby finding the solution for social and environmental issues. At present, the increasing expense of structure development materials is the factor of extraordinary concern. The test in making a light weight cement is diminishing the thickness while keeping up quality and without antagonistically influencing expense. Introducing new light weight aggregates into the mix design is a common way to lower a concrete's density.

- From the experimental results and discussions of above researches on coconut shell, the coconut shell has potential as lightweight aggregate in concrete. Likewise, utilizing the coconut shell as alternative in cement can decrease the material costing as it is easily available.
- Coconut Shell Cement can be utilized in village area and spots where coconut is abundant and may likewise be utilized where the ordinary aggregates are exorbitant.
- It is inferred that the Coconut Shells are reasonable substitute for lightweight aggregates when used to supplant normal coarse aggregates in concrete generation.
- Coconut shell exhibits comparable resistance against crushing, impact and abrasion, with respect to quarry aggregate. There is no compelling reason to treat the coconut shell before use as an aggregate aside from water absorption.

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