An Experimental Study of Concrete Mixed with Coconut Shell as Partial Replacement of Course Aggregate

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Abstract— Excessive value of traditional creative substances affects the economic structure system. The possibility of using recycled coconut shell aggregate in concrete as a coarse mix is being tested in gift research. The most satisfactory replacement rate of crude composite with coconut shell composite was determined from the research. Coconut shell is a lightweight fabric, so it creates lightweight concrete. Substitute for raw coconut shell mixture in proportions of 10%, 20% and 30%. The Design mixture used was of M20 quality and test samples were tested after 7 and 28 days of curing. Flexural and compressive energies of concrete are tests. The main goal is to inspire the use of these wastes as innovative materials in low-value housing. Aggregate is an essential ingredient for concrete production, accounting for nearly 70 to 80% of concrete. Ordinary flood rock is used as a coarse aggregate and river sand is a satisfactory aggregate. Both are clearly available substances. Due to the rapid proliferation of creative works, the reassertion of traditional combinations is very quickly exhausted, leading to enormous growth in creative value. To be sustainable, these substances must be used correctly and those that have the opportunity to update the combination on a daily basis must be sought. Many studies have been carried out to find suitable substances for concrete production. At the same time, due to the rapid pace of industrialization, scrap fabric production is increasingly developing. Getting rid of it has become a real problem. It can be concluded that the appropriate amount of coconut shells to replace the raw mixture for M20 concrete is 10-20%.

Keywords: Concrete Mix, Coconut shell, Low cost housing, Flexural strength, Compressive strength, Design mix, Replacement of Course Aggregate.

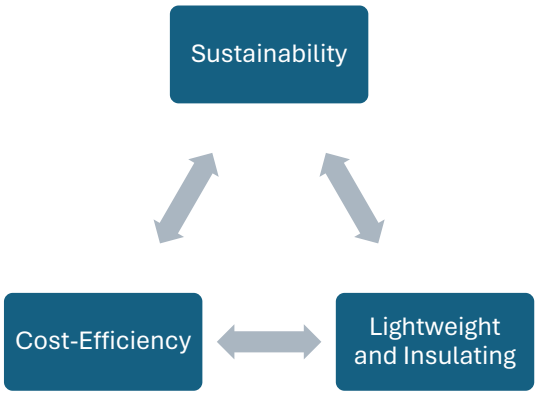
I. INTRODUCTION

The use of concrete is increasing at a faster rate thanks to infrastructure development. Due to the increasing exploitation of concrete, the continued extraction of aggregates from natural resources leads to ecological imbalance and depletion. To manage this imbalance, waste from coconut shells is used to replace aggregates. In India, 90% of coconut production is in southern India. Coconut shells are ground in a mill after sifting through a sieve. 10mm coconut shell recovered. Coconut shells are used as recycled lightweight aggregate in concrete. A research effort has been launched to “meet society's need for safe and economical waste disposal.” Using waste saves natural resources, disposal space and helps maintain a clean environment. Current concrete construction is considered unsustainable because it not only consumes large amounts of rock, sand and drinking water, but also up to 2 billion tons of Portland cement each year, which releases greenhouse gas emissions. Glass leads to global warming. Experiments were conducted on waste materials such as rubber tires, electronic waste, coconut shells, blast furnace slag, plastic waste, demolished concrete structures, wastewater... Construction waste recycling plants are now installed in various countries but they are part of the solution to the waste problem. Negative consequences of increased concrete demand include reduced aggregate deposition; environmental degradation and ecological imbalance. Concrete is one of the most adaptable construction materials. With more than 10 billion tons of concrete produced each year, it is considered the most important construction material. Therefore, the concrete industry will use a significant amount of natural resources to produce concrete. Concrete production is increasing due to strong growth in infrastructure development and construction activity worldwide. Furthermore, the demand for concrete is expected to reach about 18 billion tons per year by 2050. Coconuts are grown in more than 93 countries and Southeast Asia is considered the homeland of coconuts. By using agricultural waste, specifically coconut, to replace stone aggregate in concrete, a type of concrete was developed that has potential for use in lightweight construction. Lightweight aggregate concrete structures are an important and ingenious material. This type of concrete has a variety of applications such as the construction of frames and floors of multi-story buildings, bridges, offshore oil rigs and pre-stressed or precast structures.

I.I. SCOPE OF WORK

It can lessen the dependency on herbal resources` energy given in compression compared to standard concrete. This is waste cloth this is taken into consideration a disposal trouble and it's miles to be had in excessive quantities in without problems in India. So whilst partly changed with mixture then value might be reduced. Natural aggregates are restricted herbal resources. Thus coconut shell mixture concrete may be the fine reasonably-priced cloth in preference to herbal sand. This challenge can open a brand new benchmark in research. Our have a look at had many limitations, of which the time became a prime concern. The Durability residences of coconut shell concrete are to be rested earlier than almost making use of our challenge. Durability Tests on CSC which may also take round a 12 months to finish may be carried out as destiny work.

BENEFITS OF USING COCONUT SHELL AS PARTIAL REPLACEMENT



II. LITERATURE REVIEW

II.I. SATISH SHINDE, RAMIZ SAYED (2016)

In this paper authors mainly discussed basic things needed to make humans alive like meals, lodging, and clothes. They replaced M20 grade concrete with coconut shells as a coarse cluster. In a ratio of 1:1 cubes and circular solids were lobbed respectively and their confining and elastic strength at 4 weeks test. The confining strength and ductile strength of concrete were reduced because the proportion replacement inflated. Concrete made by replacing 10%, 15%, and 20% of the coarse mixture with coconut shell earned by twenty-eight days confining strength and ductile strength. They got the results which made a big price difference and more than that it is environment friendly.

II.II. SANJAY KUMAR (2019)

published a paper that looks at the examination of the usage of coconut shells as mostly replacement for coarse aggregate. In his work, the compressive strength of M20 grade had been thought by trading normal coarse aggregate as 0%,5%,10%,20%, and 30% by weight with the coconut shell. The compressive strength of the coconut shell was assessed on 7, 14, 21 and 28 days. On 10% trading of coarse aggregate with coconut shell the compressive strength has gotten 20.10Mpa at 28 days. On further replacement of coconut shell, there is a decrease in the compressive strength. This outcome shows that coconut shell concrete can be utilized as a lightweight concrete. Weight concrete

II.III. LOPA M. SHINDE (2015)

This paper reviews the possible use of agricultural wastes as aggregate in the concrete industry. Large volumes of natural resources and raw materials are being used for concrete production around the world in the laboratory. To reduce or minimize the undesirable environmental effects of the concrete industry and promote the environmental sustainability of the industry, the use of wastes from the industry as materials for concrete construction is considered an alternative solution for preventing the excessive usage of raw materials. It aims to support the notion of using these wastes by explaining their engineering properties. This review of existing knowledge about the successful use of agricultural wastes in the concrete industry helps to identify other existing waste products for use in concrete manufacturing. Recycling such wastes and using them in construction materials appears to be a feasible solution not only to the pollution problem but also an economical option in construction.

II.IV. APEKSHA KANOJA (2017)

In 2017 published a paper on the execution of coconut shells as coarse aggregates in concrete. This experimental examination was intended to evaluate the partial replacement of coarse aggregates with coconut shells to create concrete. Results uncovered that 40% substitution of ordinary coarse aggregates by coconut shell, 7 days compressive strength of concrete. Results uncovered that 40% substitution of ordinary coarse aggregates by coconut shell, 7 days compressive strength of concrete diminished by 62.6% where, as a decline in 28 days was just 21.5%.40 % substitution makes the concrete lighter by 7.47%

II.VI. DANIEL YAW OSEI (2013)

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%,50% and 100% and the day compressive strength were found, out.19.7N/mm2,18.68N/mm2,17.57N/mm2,16.65N/mm2and,9.29N/mm2. This shows that concrete was replaced by 20%. Coconut shells can be used as a partial replacement for crushed granite or other conventional aggregates in reinforced Increase in percentage replacements by coconut shells reduced.

II.VII. ANJALI S. KATTIRE (2017)

In 2015 published a paper where they studied a total of 16 specimens cast 8 cubes and 8 cylinders and their compressive and tensile strength were measured after 28 days. The coconut shell was used as a partial replacement and the percentages 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 the construction of lightweight members.

II.VIII. P. JAYABALAN AND A. RAJARAMAN (2014)

carried out an experimental investigation to know the effects on concrete by the addition of natural coconut fiber and replacement of cement (by weight) with different percentages of fly ash on flexural strength, splitting tensile strength, compressive strength and modulus of elasticity. Test results demonstrate that the replacement of 43-grade ordinary Portland cement with fly ash showed an increase in compressive strength, modulus of elasticity, flexural strength, and splitting tensile strength for the chosen mix proportion. The addition of coconut fibers resulting in fly ash mixed concrete composite (FMCC) did enhance the mechanical properties of fly ash mixed concrete composite and at the same time increased the energy levels reflected by increased failure strain, making the material suitable for seismic sustenance.

II.IX. OLANIPEKUN (2006)

carried out the comparative cost analysis and strength characteristics of concrete produced using crushed, granular coconut and palm kernel shell as substitutes for conventional coarse aggregate. The main objective is to encourage the use of waste products as construction materials in low-cost housing. Crushed granular coconut and palm kernel were used as a substitute for conventional coarse aggregate in the following ratios: 0%, 25%, 50%, 75%, and 100% for preparing mix ratios 1:1:2 and 1:2:4. Total of 320 cubes were cast, tested and their physical and mechanical properties were determined. The result showed that the compressive strength of the concrete decreased as the percentage of the coconut shell increased in the two mix ratios, Coconut shell exhibited a higher compressive strength than palm kernel shell in the test. Moreover, there is a cost reduction of 30% and 42% for concrete produced from coconut shells and palm kernel shells respectively

II.X. DAMRE SHRADDHA AND SHRIKANT VARPE (2014)

replaced conventional coarse aggregate with coconut shells 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.

II.XI. MANINDER KAUR & MANPREET KAUR (2012)

published a review paper in which it is concluded that the 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 to invest these materials in house construction. It is also concluded that the Coconut Shells are more suitable as strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

III. METHODOLOGY

In this project The materials used for this research are Ordinary Portland cement (OPC) 53 grade, coarse aggregate, fine aggregate (sand), and coconut shell aggregate as raw materials. The materials were used in our project. Coconut, shell, cement, Coarse aggregates, Fine aggregate, water.

III.I. COLLECTION OF COCONUT SHELL

The coconut shell is the most powerful element included in coconut fruit. The coconut shell is positioned in among the coconut flesh and coconut husk. This shell is evidently created to supply the internal a part of the coconut. The coconut shell is a excessive-capacity cloth because of its excessive electricity and modulus properties. Coconut shell is amassed from the temple and nearby coconut vendors.

Fig No.1 : Coconut Shell

Table no.1 : Properties of coconut shell

Sr no	Physical properties	Result
1	Bulk density (kg/m3)	800
2	Shell thickness	2-6mm
3	Specific gravity	1.33

Crushed Coconut shell: After collection of coconut shell, the shell is crushed with the help of crushing

Coconut shell aggregate (CSA): Coconut shells were obtained from a local market and allowed to dry under the sun for a period of half a month before being crushed

Crushed coconut shell aggregates: The coconut shells had fairly smooth concave and rough convex faces. CS aggregates have a relatively high water absorption value of nearly 6.71%, compared to the conventional fine aggregate (3%).

Fig No. 2 : Crushed Coconut Shell

Cement: Ordinary Portland Cement changed into used for this experiment. It is the principle factor used for the bonding of concrete. OPC 53 units faster than OPC 43. OPC 53 has a low Initial putting time. It is utilized in systems in which fast energy advantage is needed like load-bearing systems. OPC 53 grade cement is a form of cement desired for its excessive compressive energy. The time period “53 Grade” means that the cement attains a minimal compressive energy of 53 mega pascals (Mpa)

after 28 days of curing period. The OPC 53 grade cement has decreased permeability that corroborates with minimizing the moisture content, chemicals, and pollutants, ensuing within side the long-time period integrity of systems. Due to its excessive energy and sturdiness characteristics, systems require much less common upkeep and maintenance.

Coarse aggregate: The combination that is greater than 4.75mm is called Coarse combination. The cloth this is retained from beaten rock or beaten gravel. The Size of coarse combination used is 10mm and 20mm. The preference of combination is on the whole decided with the aid of using its bodily and mechanical homes. Basic homes of aggregates consist of mineralogical composition, floor texture and grain shape, dustiness, porosity, frost resistance, resistance to abrasion and polishing, and asphalt absorption capability The aggregates used had been 20mm nominal most length and are examined as consistent with Indian requirements and the effects are in the permissible limit.

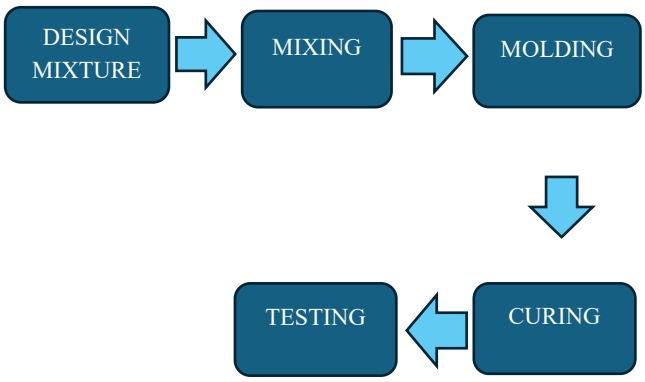
Table no 2 : Properties of Course Aggregate

Sr No	Properties	Value
1	Specific Gravity	2.76
2	Size OF Aggregate	10 mm
3	Water Absorption	0.4

Fine aggregate : Fine aggregates used have been to be had on-webweb page and are tested, the effects are as in keeping with Indian requirements BIS: 383:1970. The use of satisfactory mixture improves the compressive energy of concrete. The use of satisfactory aggregates presents higher bonding or interlocking of each satisfactory and coarse aggregates. The assessments performed on satisfactory mixture are precise gravity and water absorption. The precise gravity of satisfactory mixture is 2.65. The use of satisfactory aggregates presents higher bonding or interlocking of each satisfactory and coarse aggregates.

Water: Clean tap water and a constant water-cement ratio of 0.45 were used for the manufacture of the concrete.

Testing Methodology : A Test is carried out to find compressive strength by using the following experimental procedure



III.II. TEST TO BE CONDUCTED

Compressive strength test

This test determines the maximum compressive load that a concrete sample can withstand before failure. It helps evaluate the structural durability of concrete mixtures. This is a mechanical test that measures the maximum compressive load a material can withstand before breaking. The test specimen, usually in the form of a cube, prism or cylinder, is compressed between the plates of a compression testing machine by a slowly applied load. The compressive strength of concrete depends on many factors such as water-cement ratio, cement strength, quality of concrete materials, quality control during concrete production, etc.

RESULTS OF COMPRESSIVE STRENGTH TEST:

Sr.no	Mix	COMPRESSIVE STRENGTH N/mm^2		
		7 days	14 days	28 days
1	0%	15	18	20
2	10%	16.56	19.51	20.2
3	20%	18.13	20.45	22.1
4	30%	11.55	17.5	18.86

Fig No. 3 : Compressive strength Machine

Flexural Strength Test

Performing a flexural test in an experimental study of concrete mixed with coconut shell husk as a partial replacement of coarse aggregate helps assess the material's ability to withstand bending forces. Flexural strength is another method of measuring the tensile strength of concrete. It is a measure of and reinforced concrete beam to resist failure in bending. Flexure tests, also called bending tests, are used to test or compare plastics, including their compounds. Flexure tests provide a reliable test method with a relatively simple test arrangement. They are use to determine the stress-strain behavior of material in the range of low specimen of strain.

Fig No.4 : Flexural strength Machine

RESULTS OF FLEXURAL STRENGTH TEST

Sr.no	Mix	FLEXURAL STRENGTH N/mm^2		
		7 days	14 days	28 days
1	0%	4	4.59	4.57
2	10%	2.70	3.83	4.36
3	20%	2.38	5.45	5.30
4	30%	2.7	4.2	3.45

IV. CONCLUSION

Coconut shell has the potential to become lightweight aggregate in concrete. In addition, using coconut shells as aggregate in concrete can reduce the cost of construction materials due to their low price. Using coconut shells in concrete can help reduce waste and pollution. In general, the compressive strength of concrete with coconut shells is added. In it, we have replaced coconut shells in different proportions such as 10%, 20% and 30%. For each ratio, 3 samples were cast and processed. The compression test was performed in 3 periods, 7 days, 14 days and 28 days. After the curing process, compression test and bending test are carried out. Coconut shells can be used as a partial substitute for raw total as there is a negligible difference in quality between coconut shell and traditional total. Thus, according to our research, it can replace 20% or better for RCC concrete. The workability of concrete replaced by coconut shells is high.

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