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A STUDY ON ECONOMIC POSSIBILITY OF COCONUT SHELL AGGREGATE CONCRETE.

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Abstract

Concrete is the premier construction material around the world and is most usually employed in every kind of construction works, still as infrastructure, low and high-rise buildings, and domestic developments. Inert granular materials like sand, crushed stone or gravel type the foremost necessary part of the aggregates. Traditionally, aggregates are promptly offered at economic prices and of qualities to suit all functions. But, the continued intensive extraction use of aggregates from natural resources has been questioned because of the depletion of quality primary aggregates and larger awareness of environmental protection. Wholly completely different varied waste materials and industrial by-products like ash, recycled aggregates, crumb rubber, glass were replaced with natural combinations and investigated properties of the concrete. With the exception of on high of mentioned waste materials and industrial by-products, few studies prove that coconut shells, the agricultural by-product , will even be used as a combination in concrete.

Aggregates supply volume at low worth, comprising sixty six you have to seventy eight you look after the concrete. This study was disbursed to figure out the probabilities of exploitation of coconut shells as a combination in concrete. Utilizing coconut shells as a combination in concrete production not alone solves the matter of disposing of this solid waste but in addition helps conserve natural resources. Throughout this analysis the physical properties of crushed coconut shell combinations were presented.

Key Words: coconut shell, fly ash ,fine aggregate ,coarse aggregate ,water

1. INTRODUCTION

According to a report, coconut is mature in more than eighty six countries worldwide, with an entire production of fifty four billion around the bend per annum. India occupies the premier position among the globe with annual production of 13 billion around the bend, followed by the country and so the Philippines. Restricted analysis has been conducted on mechanical properties of concrete with coconut shells as combination replacement. However, additional analysis is needed for higher understanding of the behavior of coconut shells as a combination in concrete.

Thus, the aim of this work is to provide a great deal of data on the strengths of coconut shell concretes at wholly completely different coconut shells (CS) replacements and study the transport properties of concrete with coconut shells as coarse combination replacement. Moreover, throughout this study, the impact of ash as cement replacement and combination replacement on properties of the coconut shells replaced concrete was in addition investigated.

The concrete obtained from exploitation of coconut shell aggregates satisfies the minimum requirements of concrete. Concrete exploitation of coconut shell aggregates resulted in acceptable strength required for structural concrete. Coconut shell may offer itself as a rough combination more as a doable construction material among the sector of construction industries and this might solve the environmental downside of reducing the generation of solid wastes at constant time. Coconut shell concrete has higher workability owing to the sleek surface on one side of the shells. The impact resistance of coconut shell concrete is high compared with customary concrete. Wet mindfulness and water fascinating capability of coconut shells are a great deal compared to ancient combinations. The amount of cement content is additionally a great deal of once coconut shells are used as degree combinations among the assembly of concrete compared to ancient combination concrete. The presence of sugar among the coconut shells, as long as it's not in the associate degree of the extremely free sugar kind, will not have a bearing on the setting and strength of concrete.

2 Literature Review

Most of the man of science used coconut shell because the coarse combination replacement within the production of concrete. The aim of Kanojia and Jain's study was to spot the results of coconut shell in concrete as partial replacement the standard coarse combination. This study replaced the mixture with coconut shell by 1/3, 10%, 20%, half-hour and four-hundredth with zero.55 waters to cement quantitative relation. The strength of the specimen was taken at age seven and twenty eight days. In summary, four-hundredth replacement of coarse combination in concrete decreases the strength concerning twenty second within the twenty eight days strength. Coconut shell concrete shows low strength development at early age however it shows speedy strength development at later age. Moreover, concrete became lighter with replacement of coarse combination with coconut shell.

KAKADE AND DHAWALE had done the study towards the properties of concrete containing coconut shells in terms of characteristic compressive and durability. Percentages used for the replacement level during this study were 1/3, twenty fifth and five hundredth with zero.46 of water cement quantitative relation. The take a look at was run when seven and twenty eight days of specimens in action tank. Finally, researchers found that twenty fifth usage of coconut shell as replacement of combination satisfies the necessity for structural light-weight concrete. However, five hundredth replacement of coarse combination with coconut shell may be used for fewer necessary work.

RAO ET AL has been substituted coarse combination with coconut shell with proportions of 1/3, 100% and two hundredth. The aim of this study was to see the strength of coconut shell concretes at completely different replacement level and study the transport properties of concrete with coconut shells as coarse combination replacement. The specimens were tested for compression strength and split durability at age three, seven and twenty eight days. The conclusion attracts by researchers declared that the workability of concrete decrease with the addition of coconut shells. However, the workability will increase with the addition of ash as cement replacement. Moreover, the replacement of coconut shells decreased the strength properties of concrete.

KAMBLI AND MATHAPATI have compared the concrete containing coconut shell as coarse combination with standard concrete. Proportions utilized in this study were 1/3, 10%, 20%, half-hour and four-hundredth. The specimens were tested with compressive strength for seven and twenty eight days. It's found that the coconut shell may be used with proportions variable from 0% to 30% whereas 30% replacement of coarse combination in M20 grade concrete shows 23 Mpa strength in twenty eight days. apart from that, researchers found that the coconut shell will cut back the fabric price in construction thanks to low price and teeming agricultural waste apart from it's potential as light-weight combination.

YERRAMALA AND C have conducted experimental investigation by commutation coarse combination with 0%, 10%, 20% and 30% of coconut shell as combination replacement to review the properties of concrete with coconut shell. Tests were meted out at age one, seven and twenty eight days. Workability of the concrete decreases because the coconut shell is more. Moreover, each compressive and split durability of concrete containing coconut shell decreased compared to regulate concrete. even supposing, there's several blessings of exploitation construction and agriculture wastes as replacement material in concrete, but the concrete made should befits the quality. Hence, the determination of properties of the substitution materials is incredibly necessary as a result of it will offers result to the concrete strength either it will will increase or decreases the concrete strength.

METHODOLOGY

The ingredients of concrete i.e. cement, fine aggregate, coconut shells are tested before manufacturing concrete. As per Indian normal codes numerous check are conducted on ingredients material of the concrete such as:

Cement

- Normal Consistency of Cement
- Initial and Final Setting Times of Cement
- Compressive Strength of Cement
- Specific Gravity of Cement
- Fineness of Cement

Coarse Aggregate

- Specific Gravity of Aggregates
- Water Absorption Capacity of Aggregates
- Fineness Modulus of Aggregates

Fine Aggregate

- Bulking of Sand
- Firstly the dry ingredients cement, coarse aggregate, fine aggregate and coconut shells are fed in mixer and completely mixed to make sure even distribution. Then water is intercalary and also the combine is sustained. Production of mixture of grade M-30 is carried by IS technique of concrete combine design (IS-10262-1982).

- The numerous check that were conducted on fresh concrete to research various properties of coconut shell aggregate concrete were slump and compaction issue check.
- Coconut shell concrete is made by adding coconut shells in numerous percentages of replacement for coarse aggregate. Details of specimen area unit given below:
- Cube for compressive strength check of size 150 millimetre x 150 millimetre x 150 millimetre
- Cylinder for tensile strength check of 150 millimetre diameter and 300 millimetre height
- Water absorption check was conjointly conducted on the sample cube to check water absorption of the sample.

Finally value estimation was in hot water the producing method of coconut shell aggregate concrete therefore on study the economic viability of the coconut shell as coarse aggregate.

2 Material Used

The constituent materials utilized in this investigation were procured from native sources. These materials area unit needed by conducting numerous tests. Due to these results we tend to were outline what form of materials area unit used. We tend to area unit victimization cement, fly ash, coarse aggregate, fine aggregate, coconut shells and water.

CEMENT

Ordinary portland cement of C53 grade orthodox to each the wants of IS: 12269 and ASTM C 642-82 type-I was used. We tend to area unit conducting differing kinds of tests on cement, those are traditional Consistency, Initial and Final setting times, Compressive strength of cement, relative density and Fineness of cement. From the check results obtained the standard concrete may be designed in line with IS10262-82(MIX style CODE). Finally M30 Grade concrete is intended.

COARSE AGGREGATE

Normal aggregate that's crushed blue granite of most size twenty millimetre was used as coarse combination. We tend to area unit conducting tests on coarse combination area unit Water Absorption capability, relative density and Fineness Modulus of coarse aggregate.

FINE AGGREGATE

Well graded stream sand passing through four.75 millimetre was used as fine combination. The sand was dry and sieved to get rid of any foreign particles before mixture. We tend to area unit conducting tests on fine combination area unit Water Absorption capability, relative density and Fineness Modulus of fine aggregate.

FLY ASH

Fly ash closely resembles volcanic ashes utilized in production of the earliest well-known hydraulic cements concerning a pair of,300 years ago. Those cements were created close to the little Italian city of Pozzuoli – that later gave its name to the term pozzolan. A pozzolan is siliceous/aluminous material that, once mixed with lime and water, forms a building material compound. Ash is that the best well-known, and one in every of the foremost ordinarily used, pozzolans within the world. Rather than volcanoes, today's ash comes primarily from coal-fired, electricity- generating power plants.

COCONUT SHELL

The palm is one amongst the foremost helpful plants within the world. Coconut is grown in ninety two countries within the world. International production of coconut is fifty one billion nuts from a locality of twelve million hectares. Coconut shells that were already broken into 2 items were collected from native temple; air dried for 5 days more or less at the temperature of twenty five to thirty C; removed fiber and husk on dried shells; any broken the shells into little chips manually mistreatment hammer and sieved through 12.5mm sieve. The fabric tried and true 12.5mm sieve was wont to replace coarse mixture with coconut shells. The fabric maintained on 12.5mm sieve was discarded. Water absorption of the coconut shells was {8 may 1945|V-E Day|8 May 1945|V-day} and relative density at saturated surface dry condition of the fabric was found as 1.33.

WATER

The quality of water is very important as a result of contaminants will adversely have an effect on the strength of concrete and cause corrosion of the steel reinforcement. Water used for manufacturing and solidification concrete ought to be moderately clean and free from harmful substances like oil, acid, alkali, salt, sugar, silt, organic matter and alternative components that area unit harmful to the concrete or steel. If the water is drinkable, it's thought of to be appropriate for concrete creating. Hence, potable H2O was utilized in this study for admixture and curing. Fine particles passing through IS sieve nine, IS sieve 15, IS sieve 30 were taken and analyzed with none treatment. Conjointly coconut shells fines passing through IS sieve fifteen was taken and analyzed with treatment. The treatment consisted of soaking the coconut shells fine particles in water for durations of thirty min, 1 h, 2 h, and 1 day, two days and conjointly soaked with hot water for 2 h.

3. Tests And Results

- SLUMP TEST

Table 1 Workability of Coconut Shell Concrete

Test	0%	2.5%	5%	7.5%	10%
Slump (mm)	84	63	68	73	80
Compaction Factor	0.912	0.915	0.917	0.921	0.925

Works Limitations Of Slump Test

Following arethe limitations

1.Not suitable for concrete containing aggregates larger than 40 mm.

2.Not suitable for concrete of dry mix.

3.Not suitable for very wet concrete.

4.Not reliable because slump may be of any shape

- COMPACTION FACTOR TEST

Table 3 Recommended Values Of Workability For Various Placing Conditions

Conditions	**Degree**	**Values of Workability**
Concreting of shallow sections with vibrations	Very low	0.75 to 0.80 compacting factor
Concreting of lightly reinforced sections with vibrations	Low	0.80 to 0.85 compacting factor
Concreting of lightly reinforced sections without vibrations or heavily reinforced sections with vibrations	Medium	0.85 to 0.92 compacting factor or
Concreting of heavily reinforced sections without vibrations	High	Above 0.92 compacting factor.

Following are the advantages:

1 . Suitable for testing workability in laboratories

2 . Suitable for concrete of low workability

3 . Suitable to detect the variation in workability over a wide range

4 . Its results are more precise and sensitive.

- COMPRESSIVE STRENGTH TEST

Compressive strength is outlined as resistance of concrete to axial lading. Cells are place within the machine and formerly strain its wheel begin button is ironed as pressure is begin to use. Reading of cadence is compose once cracks area unit there on cells. Compressive strength is calculated by following formula

Compressive Strength =p/A

Where P is load and A is area of cube

- WATER ABSORPTION TEST

The increase in weight as a percentage of the original weight is expressed as its absorption (%). The average absorption of the test samples shall not be greater than 5% with no individual unit greater than 7%.

Table 5

	Coarse Aggregate replaced by	Water absorption (%)				
M30	COCONUT	0.5 hr	1hr	24 hr	72 hr	168 hr
		4.46	4.5	4.76	4.86	6.11

- SPLITTING TENSILE STRENGTH TEST

The tensile strength of concrete is one of the introductory and important parcels. Unyoking tensile strength test on concrete cylinder is a system to determine the tensile strength of concrete. The concrete is veritably weak in pressure due to its brittle nature and isn't anticipated to repel the direct pressure. The concrete develops cracks when subordinated to tensile forces. Therefore, it's necessary to determine the tensile strength of concrete to determine the cargo at which the concrete members may crack.

TABLE 6: Splitting Tensile Strength of Cylinders

Concrete Mix	**DESCRIPTION**	**SPLITTING TENSILESTRENGTH (N/mm²)**		
		7 days	**14 days**	**28 days**
	Conventional	1.93	2.51	3.71
M 30	Coarse aggregate replaced with coconut shells	1.47	2.05	2.50

3. CONCLUSIONS

It's analyzed that within the replacement of coarse aggregate with coconut shell if increase within the percent of replacement it reduced the compressive strength of the concrete.

- It's ascertained during this study that flexural strength of concrete reduces because the percent of replacement is will increase.
- Density reduced at the increment of percent replacement.
- Workability will increase because the p.c of replacement will increase because the slump factor and compaction factor will increase.

So, coconut shell is used as partial replacement of coarse aggregate, as there's marginal distinction in strength between coconut shell and convention aggregate. As a result of it's a material and extravagantly accessible within the space of its production and close to the business used coconut, one will cut back the effective price of the concrete and it's conjointly useful for the environmental purpose of read.

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