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Experimental Study on Concrete Incorporating Partial Replacement of Aggregates with Coconut Shell and Cement with Rice Husk Ash

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Abstract: ***Concrete is one of the most widely used building materials in the world. In addition, concrete is the second most widely used material in the world after water. About ten billion tons of concrete are produced annually. Annual production represents one ton per person in the world. There are negative impacts of increased concrete production such as continued extraction of natural resources from natural sources will lead to depletion and environmental inequality. So many researchers want to replace solid aggregate with concrete to save concrete and increase sustainable development. This environmental factor has caused great concern in the world of infrastructure development. The role of sugarcane, pieces of wood, plastic waste, textile waste, polyethylene, rice ash, rubber tires, vegetable fibers, paper and pulp waste in the industry, vegetable fibers, paper and pulp waste, shellfish. Other conditions for changing aggregates in concrete.***
Keywords: Coconut shell, Rice husk ash, LWC, Compressive strength, Splitting Tensile strength

I. INTRODUCTION

Concrete is the main building material that incorporates natural integration. Due to the rapid growth of industry and construction in a developing country like India, natural resources are dwindling. Finding other concrete materials is a key requirement in the current situation. Environmental issues restrictions on access to the environment and natural resources or the disposal of waste are increasingly important. Coarse aggregate is a major component of concrete for a variety of construction activities, including infrastructure development, low-rise and high-rise buildings and home development. It is a man-made product, which actually combines a mixture of cement, aggregates, water and admixture. Stainless granular materials such as sand, crushed stone or large stones part of aggregates. Traditionally aggregates were readily available at economic rates and attributes to suit all purposes. However, continued use is widely used to extract aggregates from natural resources are in doubt due to declining major quality standards and beyond environmental protection awareness.

II. LITERATURE REVIEW

G V Ramarao et al, 2015, Utilization of Rice Husk Ash and its application are used for the development of the construction industry, material science. It is the possible alternative solution of safe disposal of Rice Husk Ash. RHA becomes more economical without compromising concrete strength than the standard concrete. It becomes technically and economically feasible and viable. (G V Ramarao, 2015)

Krishkumar Patel et al, 2019, investigated concrete strength and its characteristics produced using coconut shells crushed granular as substitutes for natural coarse aggregate. Various tests on various parameters included physical properties and mechanical properties of coconut shell concrete were performed and concluded that coconut shell can be used as a replacement of coarse aggregate for the production of lightweight structural concrete. Coconut shells are applicable as partial substitute as coarse aggregates for concrete. (Krishkumar Patel, 2019)

Asif Hussain et.al, 2021, used of coconut shell in cement concrete and concluded that it reduces waste pollution. There is need to promote such waste use as building materials in affordable housing. As per his experiments and research he concluded that concrete strength decreases as the amount of coconut shell rises, but also ends that when I added 5% and 10% coconut shell to the concrete, there was less difference in power. If I add 15% coconut shell to the concrete strength was descent. That is why there is an end to the change of coconut shell in concrete; we concluded that a 10% replacement of a coconut shell is best for concrete structure. (Asif Hussain, 2021)

Pushpa et.al, 2016, prepared a mixture using M15 concrete range with 0.60 water cement ratio as per the batching weight. He concluded that performance of concrete has increased with an increase in the percentage of sand exchange with rice husks. Similarly, thewater absorption also increases during bulk density, compressive strength and flexibility of samplesdecreases with increasing amount of rice husk content in mixtures. The study suggested that up to 10percent instead of sand with rice husk, the produced concrete may be used to create pressure onceflexural members of the structure. (Pushpa Poudyal, 2016)

Sanjay et.al, 2017, stated that fine fly ash has Pozzolana property can be used as a binding material in concrete in replacement of cement. Functional, stressful and robust test strength testing was evaluated in a previous study papers on the 7th, 14th and 28th days of healing. 5% and 10% replacing cement with fly ash gives a better result too instead of 15% of fly ash energy decreases. Then it is improve concrete strength by 5% and 10% the conversion of fly ash to cement is done by adding coconut coir natural fiber length 6mm and 12mm with maximum 0.15% and 0.25% by weight of cement at M20 level of concrete. (Sanjay Kumar Ahirwar, 2017)

Vipul et.al, 2019, explained the need of replacement of concrte and waste management he to compared the public need for safe and economic disposal materials. Waste management saves the environment resources and disposal and helps to keep the place clean. Current concrete construction is unsustainable. Tests are performed on disposal such as rubber tire, e-waste, dirty plastic, dirty water etc. Currently in India, about 960 million tons of solids waste is produced annually as a product of agriculture, mining, municipal and other resources.

About 600 million tons of waste was processed produced in India from an agricultural source only. Large amount of agricultural waste a bag of sugarcane, paddy and wheat grass as well husk, jute fibers, coconut shells, coconut shells etc. Coconut shell contains 15% of the total weight of a coconut. According to 2018 reports, India is producing 11.9 million tons of coconut. So the value 1.78 million tons of coconut shells produced. (VipulMhatre, 2019)

Sanjay et.al, 2019, M – studied20 gradesby applying natural aggregates of 0%, 5%, 10%, 20% and 30%, by weight with a coconut shell. Compression of Coconut shell concrete was tested for 7, 14, 21 and 28 days. The oppressive power of the coconut shell concrete was such reduced as the percentage change increases. Concrete mixtures were tested and compared according to the compressive strength of common concrete. The results of the study indicate that Coconut Shell Concrete (CSC) can be used as a lightweight concrete. Use of coconut Shell instead of aggregate will not only be cost effective and eco-friendly, but also help solve the problem of common deficiencies such as solid aggregate. The use of such materials also reduces the risk of waste disposal garbage. (Sanjay Kumar Verma, 2019)

Ankita et.al, 2019, . comapred 25% weight rice husk ash and is also disposed of as waste. This is ashes contains amorphous silica that can be used as a pozzolana to make concrete and cement instead of discarding it. without compromising on concrete or concrete structures if you are exchanged for a certain amount concrete or concrete materials. In this study the standard Portland cement is replaced at a different rate RHA acquires strong concrete and structures that are comparable and satisfactory to those of ordinary concrete. Selected replacement rates ranged from 2.5% from 5% to 15% and carved concrete was tested. Under pressure at different ages and the results obtained are compared with standard concrete of the same grade and so on concluded that the results are comparable. (Ankit Gautam, 2019)

III. OBJECTIVE OF THE STUDY

In this present study an experimental effort has been done to check the strength of concrete when mixed with environmental waste materials as like rice husk ash and coconut shell to natural concreting materials. These materials serves as environmental hazards but can also be cost effective when comes in industrial use. The main objectives of our present study are mentioned below:

1) To determine workability of concrete mixture when replaced by natural concreting materials this workability is checked using traditional slump cone workability test method.
2) To determine the compressive strength of mixture when waste materials are mixed at different proportions.
3) To determine the splitting tensile strength of mixture when waste materials are mixed at different proportions.

IV. METHODOLOGY

A. Mix Design

M20 grade of concrete mix design was carried out as per IS: 10262-2019. In present study we have replaced coconut shells to coarse aggregate and rice husk ash to cement with different percentages of i.e. 10%, 15% and 20% and then compared with conventional concrete for various parameters such as workability, compressive strength and split tensile strength.

Table: Concrete Mix Proportions

S.No	Characteristic properties	Values
1	Grade of concrete	M -20
2	Maximum nominal size of aggregates	20 mm
3	Grade of cement	OPC 53 grade
4	Specific gravity of fine aggregate	2.65
5	Maximum water-cement ratio	0.5
6	Workability (for slump test)	100 mm
7	Grading Zone of fine aggregate	Zone-II
8	Specific gravity of cement	3.05
9	Specific gravity of coarse aggregate	2.71
10	Aggregate shape	Angular
11	Maximum temperature of concrete at the time of pouring	27 +/- 2°C
12	Maximum cement content	450 kg/m³
13	Minimum cement content	300 kg/m³
14	Method of transporting & placing	Manual
15	Water Absorption of coarse aggregate	0.97%
16	Water Absorption of Fine aggregate	1.23%
17	Exposure conditions IS-456:2019 Table no 4	Moderate
18	Cement	422 Kg
19	Fine aggregate	670 Kg
20	Coarse aggregate	1124 Kg
21	Water	197.16 lt
22	Proportion	1 : 1.58 : 2.66

The Workability, Compressive strength and Split tensile strength is tested after 7days and 28 days curing with standard specimen sizes.

V. RESULTS

A. Workability by Slump Test

	Controlled Concrete	Coconut shell content (%)			Rice husk ash content (%)			CS+RHA content (%)	
		10	15	20	10	15	20	10+10	10+15
Slump value (mm)	90	77	70	64	70	65	53	60	54

B. Compressive Strength

	Controlled Concrete	Coconut shell content (%)			Rice husk ash content (%)			CS+RHA content (%)	
		10	15	20	10	15	20	10+10	10+15
Avg. Compressive Strength (MPa) 7 DAYS	18.07	16.24	15.85	12.6	18.53	19.06	18.04	-	-
Avg Compressive Strength (MPa) 28 DAYS	28.26	27.56	24.78	19.96	28.97	29.82	28.35	28.35	29.73

C. Splitting Tensile Strength

	Controlled Concrete	Coconut shell content (%)			Rice husk ash content (%)			CS+RHA content (%)	
		10	15	20	10	15	20	10+10	10+15
Avg. Split tensile Strength (MPa) 7 DAYS	1.52	1.42	1.40	1.20	1.64	1.89	1.57	-	-
Avg. Split tensile Strength (MPa) 28 DAYS	2.47	2.48	2.23	1.79	2.55	2.80	2.44	2.84	2.93

VI. CONCLUSIONS

1) On 10% partially substituting of waste coconut shell to natural coarse aggregate, Compressive Strength of coconut shell concrete has obtained 27.56 MPA at 28 days. Therefore, to make the transition technically and economically feasible and effective. With further adjustments, a decrease in the pressure of Coconut Shell Concrete has been observed.

2) Use of coconut shell waste as a replacement of aggregate will reduce of natural Resources aggregate depletion and will also be helpful to creating eco-friendly environment.

3) from the experimental analysis we have found that 15 % replacement of rice husk ash with cement in cement concrete is beneficial replacement. And we go beyond this for further replacement in percentage of cement we will see decrease in strength of concrete

4) When combined usage of RHA and coconut shell as partial replacement of OPC and coarse aggregate gives satisfying strength at 15% RHA and 10% coconut shell.

5) As the replacement level increases the workability decreases as a result amount of water required will be more

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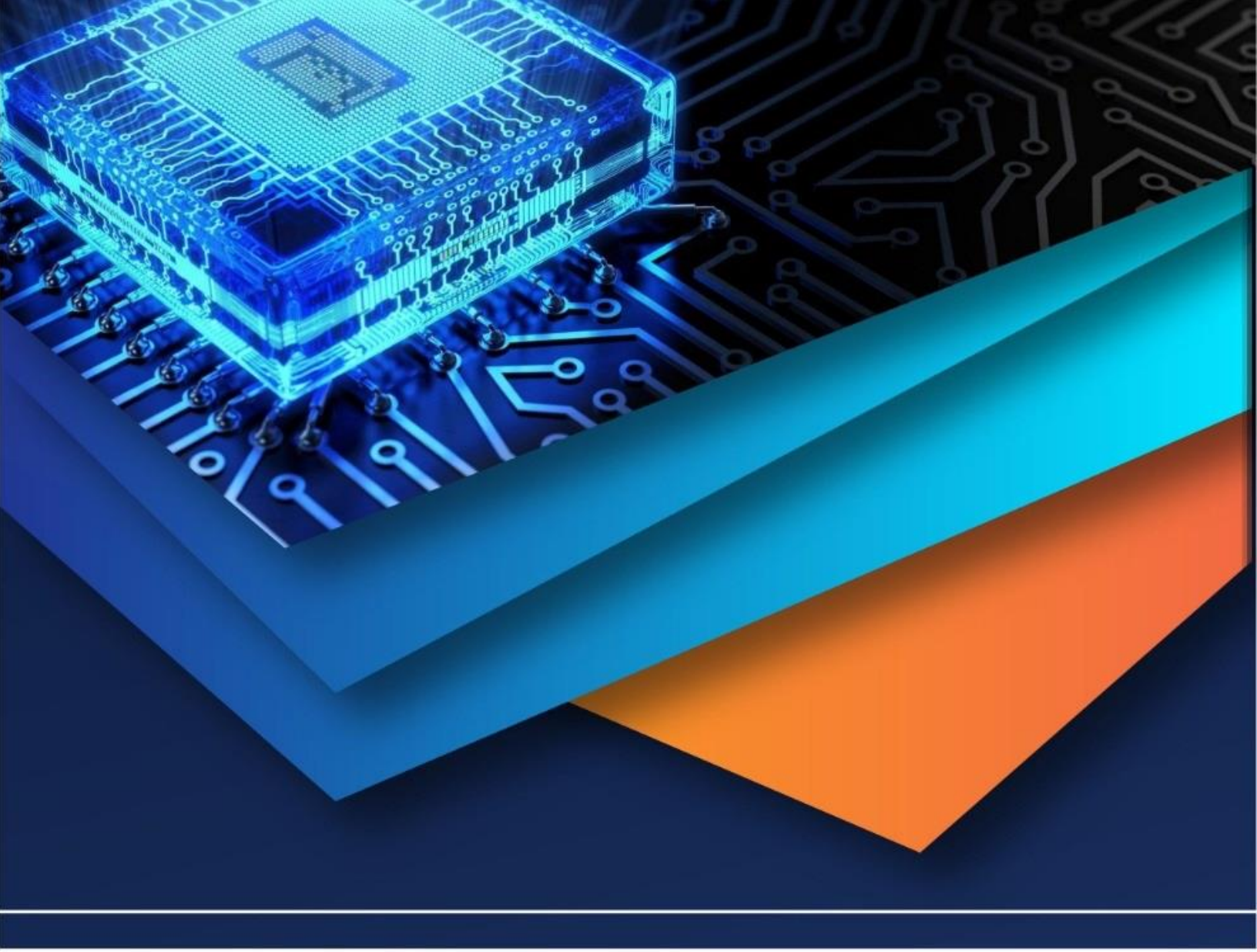

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