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AN EXPERIMENTAL STUDY ON STRENGTH BEHAVIOUR OF CONCRETE USING RICE HUSK ASH AND COCONUT SHELL FIBER FOR LOW COST HOUSING

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Abstract- Concrete is very wide topic in civil engineering field. Modification of concrete is very essential for eco-friendly environment for present scenario. Show we are using agricultural waste in concrete to modify the concrete and to reduce problems of waste disposal and land utilisation for waste. The agricultural wastes which are used in this project:-

i). Coconut shell

ii). Rise husk ash

Coconut shells are by-products of coconut oil production. Coconut shells are used in the production of activated carbon due to hardness and high carbon content. Concrete using Coconut Shell aggregates resulted in acceptable strength required for structural concrete. Coconut Shell may offer itself as a coarse aggregate as well as a potential construction material in the field of construction industries and this would solve the environmental problem of reducing the generation of solid wastes simultaneously. The impact resistance of Coconut Shell concrete is high when compared with conventional concrete. Moisture retaining and water absorbing capacity of Coconut Shell are more compared to conventional aggregate. Cost reduction of 40% can be achieved if coconut shells are used to replace gravel in concrete. The amount of cement content may be more when Coconut Shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete. Thus cement can also be replaced by rice husk ash which is an agricultural waste to make it low cost material. Rice husk ash (RHA) is a by-product from the burning of rice husk. This husk contains about 75 % organic volatile matter and the balance 25 % of the weight of this husk is converted into ash during the firing process, is known as rice husk ash (RHA). This RHA in turn contains around 85 % - 90 % amorphous silica. Thus Rise husk is replaced partially by cement and Coconut shell is replaced by aggregate in various proportions. Then the concrete specimen is compared by testing on 7th, 14th and 28th day with water cement ratio of 0.5. Compressive strength tensile strength, workability, etc will be shown in result. According to result of RHA moulds and coconut shell moulds the ratios are formed for using RHA and coconut shell together in concrete.

Keywords: Advance Concrete, Rice Husk Ash, Core Fibre, Tensile Strength.

INTRODUCTION

Concrete is the world's most used construction material. The consumption of concrete has been increasing at a higher rate due to the demand placed by the development of infrastructure in both developing and developed countries. The negative consequences of increasing demand for concrete include depletion of aggregate deposits; environmental degradation and ecological imbalance. The possibility of a complete depletion of aggregate resources has rendered continued use of aggregates for construction unsustainable. In view of this challenge, researchers throughout the world have been investigating ways of replacing aggregates to make construction sustainable and less expensive. Research addressing environmental and sustainability issues in construction has generated lot of interest in the world. While wastes generated by industrial and agricultural processes have created disposal and management problems which pose serious challenges to efforts towards environmental conservation, their use contributes to resource conservation, environmental protection and the reduction of construction costs, since waste materials can be obtained at little or no cost, while making significant contribution to the conservation of natural resources and maintenance of ecological balance. The potential of using agricultural wastes in civil engineering and building construction works have been investigated by various researchers. In today's scenario everyone looks for economic construction with good strength and durability. Conventional concrete is good but not economical where less loading and light weight concrete is required. According to the requirement of construction such as light weight concrete, high strength concrete, low cost concrete etc, we need to modify the concrete by using other materials. we have Sample amount of industrial and agricultural waste material which can be used in concrete for modification. Rice Husk Ash and Coconut Shell are agricultural waste which can be used in concrete. Cement and aggregate are replaced by RHA and Coconut Shell respectively

Concrete is one of the oldest manufactured construction materials used in construction of various structures around the world. The cost of concrete and other construction materials in Nigeria is currently so high that the majority of individuals find it difficult to afford, with the exception of Government, Industrial and Business Corporations. There had been calls from several government quarters on means to reduce the cost of Civil Engineering construction works by adopting cheap locally available engineering materials. There are many projects done in various fields of mortar, concrete and soil with the use of RHA and coconut shells for strengthening the physical, mechanical and engineering properties of construction materials. According to the results we know use of RHA gives better strength and Coconut Shell gives low cost, light weight and porous concrete. Individually both the concrete, RHA and CS perfumes good.

II LITERATURE REVIEW

A review of the literature revealed that various laboratory investigations have been conducted independently. To reduce the impact on the environment due to industrial and agricultural waste products such as Rice Husk Ash (RHA) and coconut shell which are the waste products of paddy industry and agricultural industry. Use of these materials in concrete is not only improves the strength of concrete but also leads to the proper disposal of these materials as well as gives a good for making porous concrete, resulting in reducing the impact of these materials on environment. There are various investigation performed with agricultural wastes using RHA and Coconut Shell. Few investigations are listed below.

Sabat, Akshaya Kumar, et. Al (2011).- This paper presents the result of an experimental programme undertaken to investigate the effect of randomly distributed polypropylene fiber on engineering properties of an expansive soil stabilised with optimum percentage of Rice husk ash (RHA) and lime. The engineering properties determined were Maximum dry density (MDD),Optimum moisture content (OMC), Unconfined compressive strength (UCS), Splitting tensile strength, Soaked California bearing ratio (CBR),Swelling pressure,and durability. The results of the tests have shown significant improvement in these properties. For best utilization effect the optimum percentage of RHA is 10%, lime is 4% and polypropylene fiber is 1.5%, **Ling, I. H. and Teo,(2013)**- Reuse of agricultural wastes and industrial by-products for building materials has been gaining popularity in the recent years. Agricultural waste material; namely rice husk ash (RHA), and industrial by-product; namely expanded polystyrene beads (EPS) are discarded in large amounts globally, causing increased environmental problems. Therefore, this paper introduces innovative efforts of the combined use of RHA and EPS wastes for the production of EPS RHA lightweight concrete bricks. Results showed that the commercial development of EPS RHA bricks is not only highly promising but also effectively sequestering the accumulation of these waste materials

Chemical Composition of Rise Husk Ash:-

The chemical composition of rice husk ash. The total percentage composition of iron oxide (Fe_2O_3= 0.95%), Silicon dioxide (SiO_2= 67.30%) and Aluminum Oxide (Al_2O_3= 4.90%)was found to be 73.15%.

Table 1. Physical Properties of RHA

Sr. no.	Parameter	Test Value	Method of Test
1.	**Particles retained on 45 micron IS sieves (Wet Sieving) in % Max**	**27.13**	**IS:1727:1967**

Table 2. Chemical Properties of RHA.

S. No.	Parameters	Test Value	Method of Test
1.	Silica as SiO2 % w/w	83.6	IS:1727:1967
2.	Calcium Oxide as CaO % w/w	0.84	IS:1727:1967
3.	Magnesium Oxide MgO % w/w	0.40	IS:1727:1967
4.	4 Alumina as Al2O3 % w/w	0.76	IS:1727:1967
5.	Ferric Oxide as Fe2O3 % w/w	0.64	IS:12423:1988
6.	Loss on Ignition % w/w=]	14.2	IS:1727:1967
7.	Sulphuric Anhydride as SO3 % w/w	0.69	IS:1727:1967

III METHODOLOGY

In The modified concrete is prepared by using agricultural waste. The wastes RHA and CS are collected from AKALTARA and temples of RATANPUR respectively. The rice husk is transported from AKALTARA then it is burnt and ash is collected. Collected ash is sieved by 75 micron sieve. in the same time CS is collected from the temples and broken into 20mm sized pieces then immersed in water for 12 hours. Initial tests of cement, aggregate, RHA and CS is performed in LNCT BHOPAL. Then according to the M20 mix Design (1:1.51:3.06) with water cement ratio 0.5% , concrete is prepared by replacing cement with RHA by 5%, 10%, 15% and 20%. This mould preparation is called as specimen 1. Then with same procedure specimen 2 is prepared with replacing aggregate with coconut shell by 20%, 40%, 60%, 80% and 100%. Moulds are kept in a tank with full of water for curing. Compressive and tensile tests are performed for getting its strength on 7^{th}, 14^{th} and 28^{th} day. Results are checked and analysed for specimen 3. The Moulds of specimen 3 is prepared by using both RHA and CS together replacing cement and aggregate respectively with various ratios. The ratios are obtained by the result of specimen1 and specimen 2. Same as specimen 1 and specimen2 the moulds are kept for curing and tests are performed. Now all the three specimens are compared with properties of convention concrete and used according to the requirement.

The IS method treats normal mixes (up to M35) and high strength mixes (M40 and above) differently. This is logical because richer mixes need lower sand content when compared with leaner mixes. The method also gives correction factors for different w/c ratios, workability and for rounded coarse aggregate. In IS method, the quantities of fine and coarse aggregate are calculated with help of yield equation, which is based on specific gravities of ingredients. Thus plastic density of concrete calculated from yield equation can be close to actual plastic density obtained in laboratory, if specific gravities are calculated accurately. Thus actual cement consumption will be close to that targeted in the first trial mix itself. The water cement ratio is calculated from cement curves based on 28 days strength of cement. This can be time consuming and impractical at times. The IS method gives separate graphs using accelerated strength of cement with reference mix method. This greatly reduces the time required for mix design.

Fig 1. Slump cone test

Fig 2. Curing of concrete

Fig 3. Tensile Test

IV RESULTS

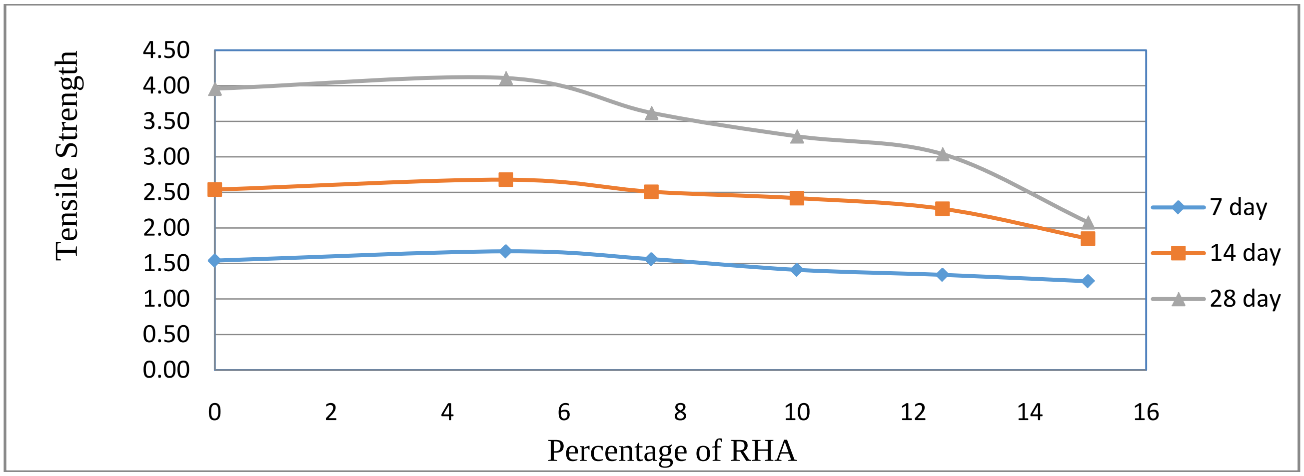
A. TENSILE STRENGTH TEST:

The results show that the Tensile strength at 28 days increased with the replacement of 25percent cement with RHA. This is due to the higher specific area of the RHA which accelerated the pozzolanic reaction. Another possible reason may be the presence of higher CaO content in the RHA. The results of the present investigation indicate that the percentage of RHA contributing to the mechanical properties is more significant than that of control concrete.

Table 3. Tensile Strength of RHA Concrete

Sr. No.	Ratio (%)		Amount (kg/m3)				7 Day	14Day	28Day
	R.H.A.	Cement	Cement	RHA	Sand	Aggregate			
1	0	100	384.35	0	580.4	1176.1	1.54	2.54	3.96
2	5	95	365.15	19.2	580.4	1176.1	1.67	2.68	4.11
3	7.5	92.5	355.55	28.8	580.4	1176.1	1.56	2.51	3.62
4	10	90	345.90	38.44	580.4	1176.1	1.41	2.42	3.29
5	12.5	87.5	336.31	48.04	580.4	1176.1	1.34	2.27	3.04
6	15	85	326.70	57.65	580.4	1176.1	1.25	1.85	2.08

The result of the Tensile strength of concrete cubes shows that the Tensile strength upto 12.5% replacement gives good result and reduced as percentage of RHA increase after 12.5%. However, the Tensile strength increased as the no. Of days of curing increased for each percentage RHA replacement. It is seen from Graph 3that for controlled cube, the Tensile strength increases from 1.34 N/mm2 at 7 day to 3.04 N/mm2 at 28days.

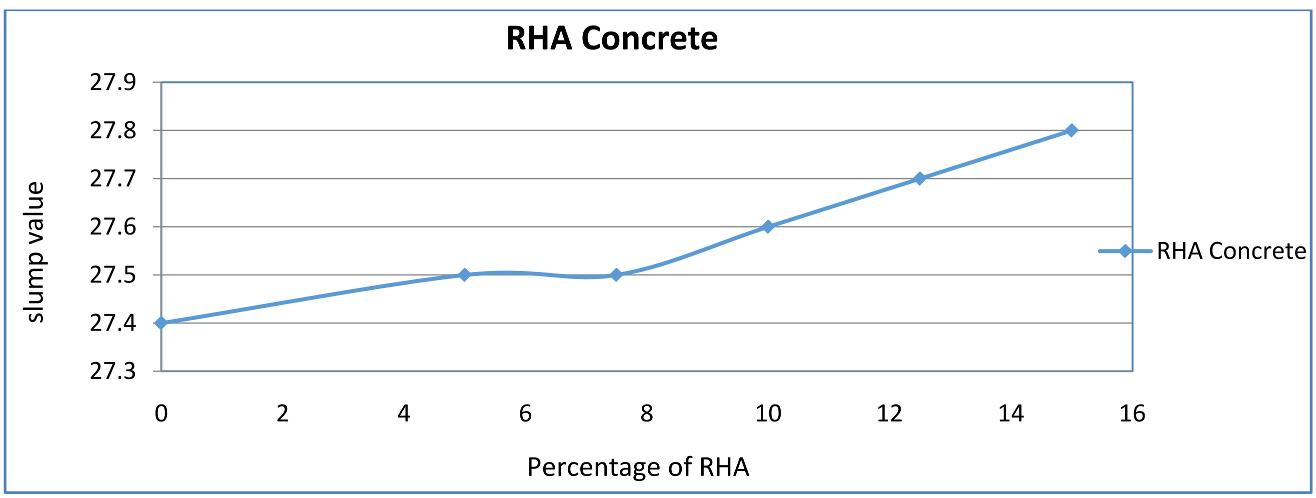


Graph 1. Tensile Strength of RHA Concrete

B. SLUMP CONE (WORKABILITY TEST):

Table 4. Slump Cone Value of RHA Concrete

% of RHA	0	5	7.5	10	12.5	15
Slump Value	27.4	27.5	27.5	27.6	27.7	27.8
Slump	2.6	2.5	2.5	2.4	2.3	2.2



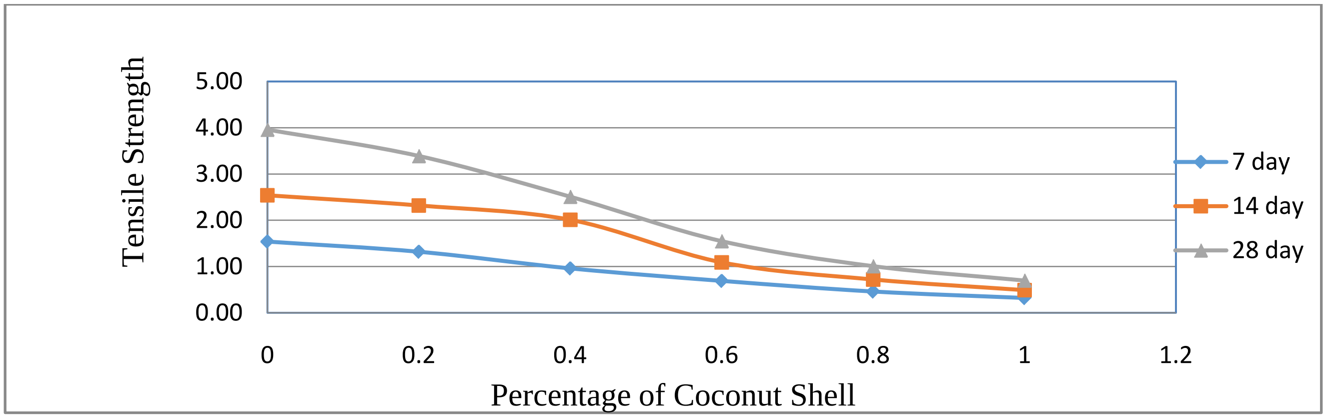
Graph 2. Slump Cone Value Of RHA Concrete

C. TENSILE STRENGTH TEST:

The result of the Tensile strength of concrete cubes shows that the Tensile strength upto 40% replacement gives good result and reduced as percentage of Coconut shell increases after 40%. However, the Tensile strength increased as the no. Of days of curing increased for each percentage Coconut Shell replacement. It is seen from Graph that for controlled cube, the Tensile strength increases from 0.96 N/mm2 at 7 day to 2.51 N/mm2 at 28days.

Table 5. Tensile Strength of Coconut Shell Concrete

Sr. No.	Ratio		Amount(kg/m3)				7 Day	14 Day	28Day
	Coco-Nut Shell	Aggregate	Cement	Sand	Coconut Shell	Aggregate			
1	0	100	384.35	580.4	0	1176.1	1.54	2.54	3.96
2	20%	80%	384.35	580.4	235.22	940.88	1.32	2.32	3.39
3	40%	60%	384.35	580.4	470.44	705.66	0.96	2.01	2.51
4	60%	40%	384.35	580.4	705.66	407.44	0.69	1.09	1.55
5	80%	20%	384.35	580.4	940.88	235.22	0.46	0.72	1.01
6	100%	0%	384.35	580.4	1176.1	0	0.32	0.49	0.7

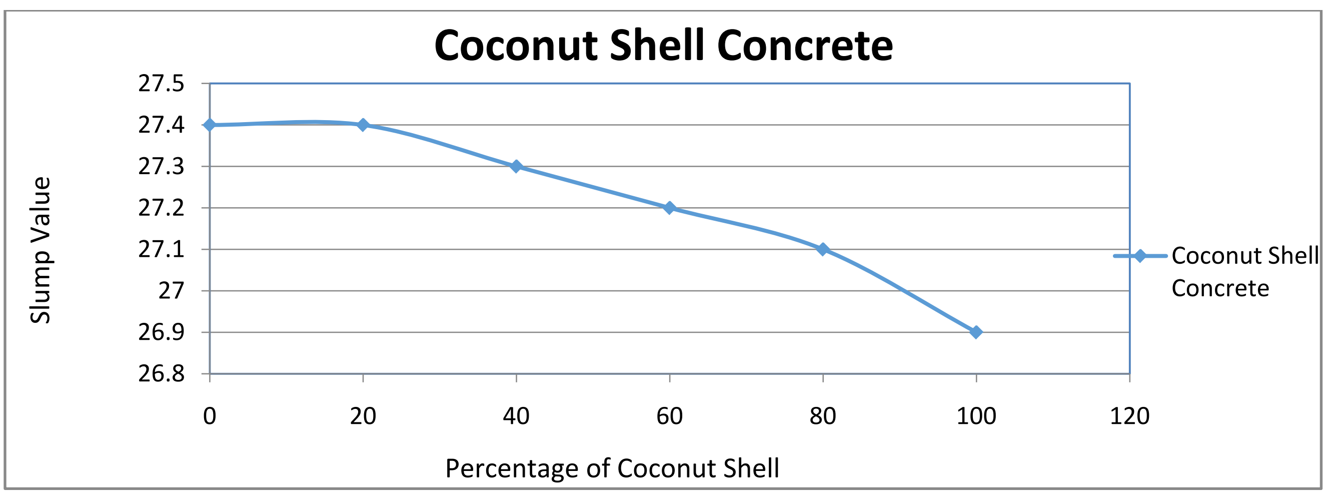


Graph 3. Tensile strength of Coconut Shell Concrete

D. SLUMP CONE (WORKABILITY TEST):

Table 6. Slump Cone Value of Coconut Shell Concrete

% of CS	**0**	**20**	**40**	**60**	**80**	**100**
Slump Value	**27.4**	**27.4**	**27.3**	**27.2**	**27.1**	**26.9**
Slump	**2.6**	**2.60**	**2.70**	**2.80**	**2.90**	**3.10**



Graph 4. Slump Cone Value of Coconut Shell Concrete

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