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Strength Behaviour of Cement Concrete By Supplementing the Coconut Shell &Egg Shell Powder as the Fine Aggregate at Different Dosages, Fly Ash for the Cement

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Abstract:
Present construction era, cost of building materials are raising day by day, use of alternative material is a partial replacement of cement & coarse aggregate, fine aggregate is become prominent , The waste materials used such as coconut shells, eggshells, thermal ash, foundry sand etc The use of waste materials with pozzolanic properties in concrete production is a becoming famous the assessment of the pozzolanic activity of cement replacement materials is becoming increasingly important because of the need for more sustainable cementing products. Coconut powder and egg shell powder is used as partial replacement in concrete ranges of 5%, 10 %, 15 %, 20% for M25 grade. Strength tests were carried out to assess the feasibility of using coconut shell powder and egg shell powder as partial replacement of cement in concrete. After casting the concrete cubes we will correlate the results and prepared report for the feasibility of usage in new advancement in concrete. So here in our thesis we will use coconut shell powder, eggshell powder as replacement for fine aggregate and fly ash as for cement. We will produce M25 grade concrete cubes and conduct various strength tests on cubes and compare those results and make a single point conclusion by using this manuscript. Number of trial mixes is required to select desired optimum replacement of aggregate by coconut shell powder, eggshells powder waste material. So in our project is replacing the coconut shells and eggshells powder on concrete to achieve the required strength of concrete.

I. INTRODUCTION

Concrete is the widely used number one structural material in the world today, high cost of cement, used as binder, in the production of mortar, sandcrete blocks, lancrete bricks and concrete has led to a search for alternative. The overall relevance of concrete in virtually all civil engineering practice and building construction works cannot be overemphasized. The growing concern of resource depletion and global pollution has challenged many researchers and engineers to seek and develop new materials relying on renewable resources. These include the use of by-products and waste materials in building construction. Many of these by-products are used as aggregate for the production of lightweight concrete (Vishwas and Sanjay, 2013). Concrete is the most commonly used building material in the world. Its huge popularity is a consequence of several advantages, such as general availability, wide applicability and low cost. These advantages are also accompanied by a great environmental burden. The billions of tons of raw materials mined and processed each year leave a mark on the environment. Furthermore, during the production of Portland cement large quantities of CO2 are released into the atmosphere and enormous amount of energy are required. Portland cement is one of the most important ingredients of concrete. With the global economic recession coupled with the market inflationary trends, the constituent materials used for these structures had led to a very high cost of construction. to a very large extent, on concrete as major construction material. The versatility, strength and durability of cement are of utmost priority over other construction materials. The basic materials for concrete are: cement, fine aggregate , coarse aggregate and water, the overall cost of concrete production depends largely on the availability of these constituents. Reduction in construction costs and the ability to produce light-weight concrete structures (LWC) are added advantages. The primary aim is to determining the suitability of partial replacement of cement with coconut shell Powder (CSP) and Egg shell powder (ESP) in concrete.

1.1 OBJECTIVES:

The objectives of this study are as follows
a) To investigate the best mix proportion of the partial replacement of egg shell powder for cement in concrete by the value of strength per weight ratio of sample specimen.
b) To investigate the feasibility of the partial replacement of above material in concrete by determining its compressive strength and split tensile strength.
c) Based on the test results, to suggest most approximate level of adding egg shell powder ,coconut shell powder & fly ash

1.2 SCOPE OF THE STUDY

Consumption of cement can be reduced significantly if eggshell powder used as a partial replacement without compromising performance characteristics of concrete including durability. The scope of study is to establish to achieve the objectives and this study will be mainly concentrated on experimental works. Experiments regarding compression strength and split tensile strength on the partial replacement of egg shell powder, coconut shell powder in concrete will be carried out in order to study the behavior of concrete. All testing methods and procedure are specified according to Indian Standard

II. LITERATURE REVIEW

Praveen Kumar, et.al., (2015) Shows that the Experiment is explained that the egg shell powder is replaced 10%,20% and

30% by cement in concrete in addition with 5%,10%,15% of weight of cement. The egg shell powder replacement is sufficient enough for getting higher strength. The flexural strength of the egg shell concrete increases with the addition of egg shell powder. The Split tensile strength of the egg shell powder concrete decrease with the addition of egg shell powder. This can be increase s used with reinforcement.

Shaik Akhil Masten et.al., (2015) Explained that the experimental study is an attempt to find the optimum usage of fly ash and egg shell powder in normal concrete by replacing the river sand 7%, 14%, 21%, 28%, &35 % by weight atvarious proportions. Fly ash & egg shell powder could be very conveniently used in structural concrete.

Olanitori LMet.al., (2015) Shows that the experiment is explained that using a mix design ratio of 1:2:4 and water binder ratio of0.63 concrete cubes were casted using varying Ordinary Portland Cement: Palm Kernel shell ash & Ordinary Portland cement: coconut shell ash ratios of 100:0, 90:10, 80:20, 70:30, 60:40, & 50:50 respectively. Reducing the production cost and the environmental pollution caused by the dumping of the agricultural waste.

Niya Eldhose et.al., (2015) Explained that the experiment is explained that the replacing the cement by egg shell powder (ESP) 5%, 10%, 15% andFine aggregate by Crumb Rubber (CR) 2.5%, 5%, 7.5%&10%. The compressive strength of concrete decreased withincrease in varying percentage of Crumb rubber Result of Replacing cement by 5% ESP in 10% Crumb Rubber replaced concrete shows increase in both flexural and split tensile strength.

Sargunan K, et.al., (2014) Explained that the experiment is explained that the cement is partially replaced with egg shell powder as 5%, 10%, 15%, 20%, 25%,30% by weight of cement. & the replacement of 5% Egg shell powder + 10% Microsilca replacement in cement yields similar flexural strength as in conventional concrete. Micro silica replacement in cement yields higher Split Tensile strength as compared to other compositions.

AMARNATH YERRAMALA et.al., (2014) studied the Properties of concrete with eggshell powder as cement replacement. This paper describes research into use of poultry waste in concrete through the development of concrete incorporating eggshell powder (ESP). Different ESP concretes were developed by replacing 5-15% of ESP for cement. The results indicated that ESP can successfully be used as partial replacement of cement in concrete produc-tion. The data presented cover strength development and transport properties. With respect to the results, at 5% ESP replacement the strengths were higher than control concrete and indicate that 5% ESP is an optimum content for maximum strength. In addition, the performance of ESP concretes was comparable up to 10% ESP replacement in terms of transport properties with control concrete.

DOH SHU ING AND CHIN SIEW CHOO et al., (2014) carried out an investigation on egg shell powder as potential additive to concrete. In this investigation, five different percentages of egg shell powder with respect to cement was added into concrete mix of grade M25. Based on the investigation they came across the conclusion that water cement ratio of 0.4 produces medium workability, ESP as filler in concrete had improved the compressive strength of concrete and maximum strength was obtained at 10% replacement. Flexural strength of concrete was improved with addition of ESP to concrete compared to control concrete mix. ESP has an addition to concrete had improved the resistance to failure under bending and water absorption was reduced at initial stage.

MTALLIB AND RABIU et al., (2009) carried out the investigation on properties of ESA as an admixture in concrete. They conducted consistency test on ESP. It was observed that higher the contents of ESA in the cement, the faster the setting of cement. The decreased setting time of OPC was due to addition of ESA portrays ESA as an accelerator.

K. UMA SHANKAR Jet al., revealed that the use of egg shell powder, GGBS and saw dust ash as concrete. Egg shell plays a major role, as it is used in all the combination of the concrete cubes. The tests revealed encouraging results for the study. The sample of blended cement consists of 20% of egg shell powder, 50% of GGBS and 10% of saw dust ash. The proportion of the mineral admixtures is applied in testing cubes for their compressive strength

III. MATERIALS & REPLACEMENTS:

a) Cement (53 grade)
b) Fine aggregate
c) Coarse aggregate
d) Coconut shell powder (CSP)
e) Egg shell powder(ESP)
f) Fly ash

EGG SHELL: In the present work, egg shells which was a waste material was collected from bakeries, fast food restaurants and are sun dried. Stored egg shell was powdered in flour mill. The grinded egg shells were sieved through the 90 micron sieve size and then packed to use it in the cement replacement.

Coconut shell powder

The budding if waste coconut shells are used as a alternative for coarse aggregate in concrete. After the coconut is tattered out, the shell is regularly discharged. The bulk density of coconut shell is about 500 -600 kg/m3, producing concrete of about less than 2000kg/m3 in density, which makes thatlight weight. the coconut shell concrete straight forward attains the strength around 17 N/mm2.for the past 10 years light weight concrete getting a maximum hold in the construction industry.

FLYASH POWDER:

Fly ash, a principal by-product of the coal-fired power plants, is well accepted as a pozzolonic material that may be used either as a component of blended Portland cements or as a mineral admixture in concrete.In commercial practice, the dosage of fly ash is limited to 15%-20%by mass of the total cementitious material. Usually, the amount has a beneficial effect on the workability and cost economy of concrete but it may not be enough to sufficiently improve the durability to sulfate attack, alkali-silica expansion, and thermal cracking. For this purpose, larger amounts of fly ash , on order of 25%-35% are being used. Although 25%-35% fly ash by mass of the cementitious material is considerably higher than 15%-20%, this is not high enough to classify the mixtures as HVFA concrete. From theoretical considerations and practical experience the authors have determined that, with 50% or more cement replacement by fly ash. It is possible to produce sustainable, high performance concrete mixtures that show high workability, high ultimate strength, and high durability.

METHODOLOGY& EXPERIMENTAL WORK

In the present study, we are used concrete cube moulds of size (150×150×150)mm for compression test and 150mm diameter, 300mm height cylinders for split tensile test. The specimens are casted for M25 grade concrete by replacement of cement by Fly ash,for fine aggregate,CSP,ESP (0 to 20 %).Hand mixing is to be used for concrete mixing. After casting required specimens, the specimens will be cured by normal water curing at temp 270C ± 2 0C. After curing, the cubes are subjected to compression test for 7 and 28 56 days and cylinders are subjected to tensile test for 28days by using compression testing machine at the rate of loading 140 kg/cm2 or 14N/mm2/min as per IS:516-1959.

IV. TEST RESULTS:

Combined replacement of materials average compressive strength results of cement concrete cubes

S.NO	CUBE ID	% OF REPLACEMNT(C+E+F)	AVERAGE C.C @ 7DAYS
1	CEF-1	0	**20.45**
2	CEF-2	5	**21.23**
3	CEF-3	10	**21.83**
4	CEF-4	15	**21.89**
5	CEF-5	20	**21.89**

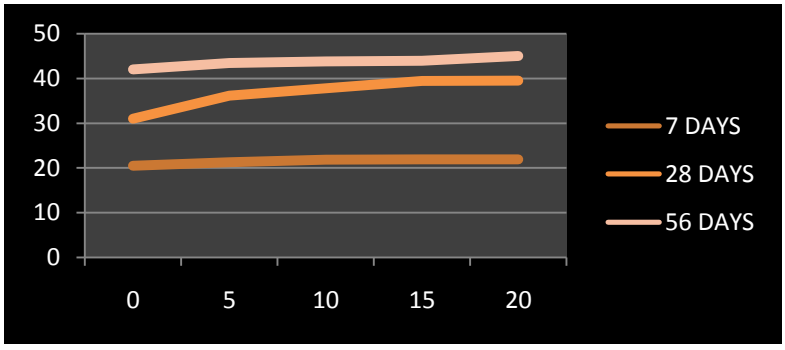
CEF 7 days compressive strength

S.NO	CUBE ID	% OF REPLACEMNT(C+E+F)	AVERAGE C.C @ 28DAYS
1	CEF-6	0	**31.00**
2	CEF-7	5	**36.12**
3	CEF-8	10	**37.75**
4	CEF-9	15	**39.42**
5	CEF-10	20	**39.49**

CEF 28 days compressive strength

S.NO	CUBE ID	% OF REPLACEMNT(C+E+F)	AVERAGE C.C @ 56 DAYS
1	CEF-11	0	**41.98**
2	CEF-12	5	**43.43**
3	CEF-13	10	**43.76**
4	CEF-14	15	**43.87**
5	CEF-15	20	**44.97**

CEF 56 days compressive strength



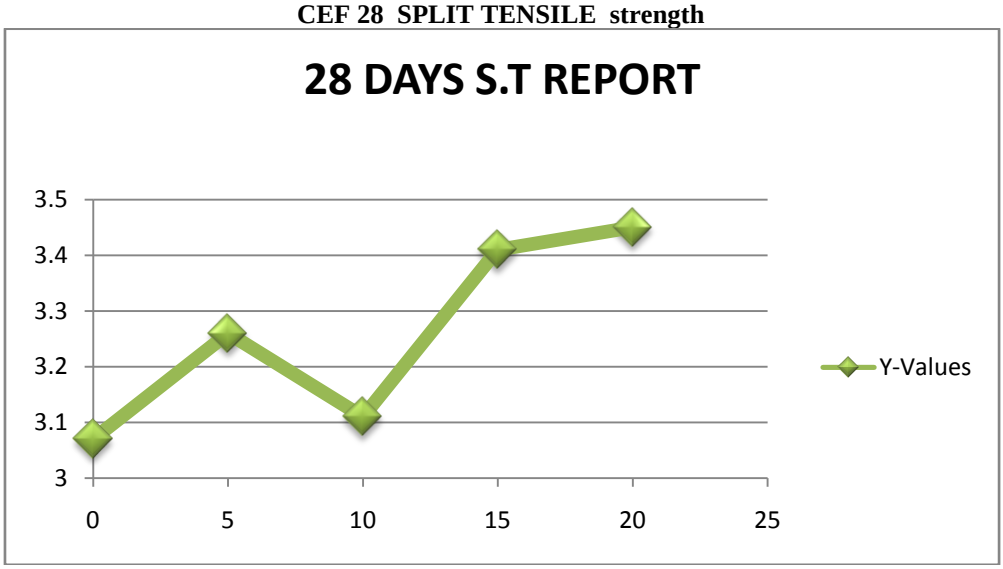
COMBINED GRAPH : FINE AGGREGATE + CEMENT

(EGG SHELL POWDER + COCONUT SHELL POWDER) + FLY ASH

Split tesnile strength reports;

S.NO	C-ID	% of replacement of (CSP+ESP+FA)	28 DAYS
1	CEF-A	0	**3.07**
2	CEF-B	5	**3.26**
3	CEF-C	10	**3.11**
4	CEF-D	15	**3.41**
5	CEF-E	20	**3.45**

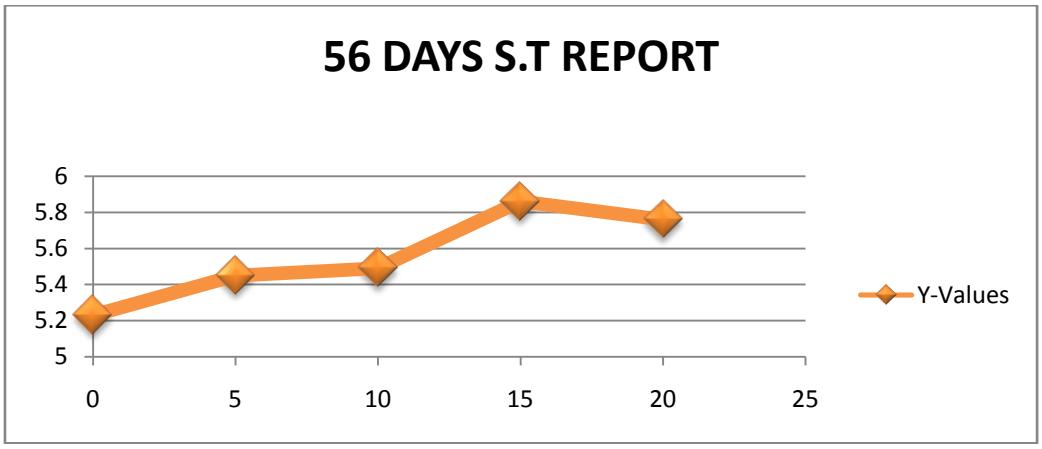
CEF 28 SPLIT TENSILE strength



Cef Curve @ 28 Days

S.NO	C-ID	% of replacement of (CSP+ESP+FA)	56 DAYS
1	CEF-F	0	**5.23**
2	CEF-G	5	**5.45**
3	CEF-H	10	**5.49**
4	CEF-I	15	**5.86**
5	CEF-J	20	**5.76**

CEF @56DAYS SPLIT TENSILE strength



CEF CURVE @ 56 DAYS

Ultrasonic pulse velocity test reports for cubes:

S NO	CUBE ID	% REPLACEMENT OF (ESP+CSP+FA)	**Obtained average velocity(m/s)**	**Quality of Concrete**
1	**CEF-1**	**0**	**3821**	**Good**
2	**CEF-2**	**5**	**4245**	**Good**
3	**CEF-3**	**10**	**4287**	**Good**
4	**CEF-4**	**15**	**4891**	**Excellent**
5	**CEF-1**	**20**	**4896**	**Excellent**

CEF UPV RESULT (1-5)

S NO	CUBE ID	% REPLACEMENT OF (ESP+CSP+FA)	Obtained average velocity(m/s)	Quality of Concrete
1	**CEF-6**	**0**	**3567**	**Good**
2	**CEF-7**	**5**	**4123**	**Good**
3	**CEF-8**	**10**	**4298**	**Good**
4	**CEF-9**	**15**	**4876**	**Excellent**
5	**CEF-10**	**20**	**4878**	**Good**

CEF UPV RESULT (6-10)

S NO	CUBE ID	% REPLACEMENT OF (ESP+CSP+FA)	Obtained average velocity(m/s)	Quality of Concrete
1	**CEF-11**	**0**	**3123**	**Good**
2	**CEF-12**	**5**	**4444**	**Good**
3	**CEF-13**	**10**	**4743**	**Excellent**
4	**CEF-14**	**15**	**4574**	**Excellent**

CEF UPV RESULT (11-15)
MODULUS OF RUPTURE RESULTS:

S NO	CUBE ID	% REPLACEMENT OF (ESP+CSP+FA)	7 DAYS
1	CEF-A	0	25.04
2	CEF-B	5	23.11
3	CEF-C	10	21.74
4	CEF-D	15	19.74
5	CEF-E	20	19.98

CEF MOR RESULT (A-E)

S NO	CUBE ID	% REPLACEMENT OF (ESP+CSP+FA)	28 DAYS
1	CEF-F	0	33.12
2	CEF-G	5	30.18
3	CEF-H	10	29.87
4	CEF-I	15	29.01
5	CEF-J	20	28.78

CEF MOR RESULT (F-J)

S NO	CUBE ID	% REPLACEMENT OF (ESP+CSP+FA)	56 DAYS
1	CEF-K	0	38.12
2	CEF-L	5	34.18
3	CEF-M	10	32.70
4	CEF-N	15	32.19
5	CEF-O	20	31.78

CEF MOR RESULT (K-O)

V. DISCUSSIONS & RESULTS

- ♠ CEF-1 posses 20.45 Mpa for genuine concrete mix
- ♠ CEF-2 Posses 21.23 Mpa for blended concrete mix
- ♠ CEF-3 shows slight increment in the compressive strength
- ♠ CEF-4 also giving same compressive strength with slight varies

- ♠ CEF-5 gave a good compressive as CEF-4
- ♠ Lke that we analyzed the report from the three curing reports of the cubes with ID –CEF-7,CEF-8,CEF9,having good compressive strength report compared to all the Cube reports.
- ♠ Finally from the compressive strength reports it shows the replacements of blend is very cost effective and giving good compressive strength results when it replaced
- ♠ But in this experimental work EGGSHELL powder making is a late process and bringing form outdoor is difficult
- ♠ Coconut powder making from grinding is easy but storage and sieving is very hard while doing
- ♠ Fly ash is good admixture to the concrete mix .over all by this coconut powder and fly ash mixing is easy .egg shell powder in not a sufficient one to do these high strength concretes.
- ♠ Split tensile strength results giving a satisfactory results at 28 days and 56 days
- ♠ The tensile property of concrete is little bit increment at some mixing dosages
- ♠ After completion of the UPV test results are also gave a excellent report at 56 days report at 15 % replacement of CEF.
- ♠ Based on flexure it shows very good results at ages 28, 56 days but one thing from the result the flexure values are decreased when after ten percentage replacements.
- ♠ But overall replacements with CEF shows very satisfactory reports

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