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Economic Analysis of Effective Use of Natural and Artificial Waste Material in Concrete

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Abstract:
Abundant availability of natural resources has become a dream for present day engineering society due to large scale consumptions. The unaccountable population growth rate makes problem of availability of coarse aggregate for construction more severe. Due to rapid Urbanization and industrialization, consumption of aggregates increased to manifold. So, the researchers must find the alternatives for the coarse aggregate. The increase in population also increases the industrial by products, domestic wastes etc. It has been noticed in India that coconut shell (CS) as an agricultural waste, requires high dumping yards as well as an environmental polluting agent. Experimental study is undertaken to investigate the effects of replacement of coarse aggregate by different percentages of coconut shell on mechanical properties of this composite concrete. Concrete consist of various ingredients like Cement, Coarse aggregate and Fine aggregate with w/c ratio 0.46 in proportion. Cement acts as binding material & now a day's partly replaced with fly ash. Fly ash is a waste product of power plants... The disposal of fly ash is big problem now days. An experimental analysis is proposed to replace cement & aggregate by the artificial and natural waste product like fly ash and coconut shell in different proportion. Coconut shell is hard and light weight material. The properties of coconut shell and aggregate is examined and the suitability of coconut shell aggregate in construction is also examined. The main objective is to analyze he usefulness of fly ash, coconut shell and glass as a construction material and to prepare lightweight concrete by using coconut shell as coarse aggregate. The experimental study is carried out on strength characteristics of M30 concrete with replacement of 10% & 20% of cement, coarse aggregate and fine aggregate by fly ash, coconut shell and glass .The water cement ratio is 0.46 by using compressive, tensile strength of concrete at, 03, 07 & 28 days are determined with experimental analysis and the results are compared with conventional concrete. Further this paper examines the economical aspect between conventional concrete and modify concrete.

Keywords: Economic Analysis Fly Ash**,** Coconut shell, Glass, Compressive Strength, Tensile Strength, Waste Material

I. INTRODUCTION

The demand for material has been continuously rising with the increasing need for housing both in rural and urban areas. The resource used to manufacture construction materials affect the environment by depleting natural resources, using energy, and Releasing pollutants on the land and water .Commercial exploitation of traditional building materials by various industries has aggravated the situation. It has, therefore, become necessary to think over this problem seriously and to provide some sustainable solution to make the alternative materials available to solve the housing problem. With consideration of these points, the effective use of alternative material for conventional concrete ingredients is studied.
Coconut Shell: Coconut shell is found throughout the tropic and sub-tropic area... Coconut trees are located among the most common sights throughout the costal areas like Kerala. Various southern states combined account for almost 92% of the total production in the country: Kerala (45.22%), Tamil Nadu (26.56%), Karnataka (10.85%), and Andhra Pradesh (8.93%). Other states, such as Goa, Maharashtra, Odisha, West Bengal, and those in the northeast (Tripura and Assam) account for the remaining 8.44%.India produces a 10,824,100 tones/year of Coconut.

Glass: Glass is mixture of number of metallic silicates. It is one of the most versatile and oldest materials in the building industry. From its humble beginnings as a window pane in luxury houses of Pompeii to sophisticated structural members in new age buildings, its role in architecture has evolved over the years.

Fly ash: Fly ash is one of the residues generated in the combustion of coal. Fly ash is generally captured from the chimneys of power generation facilities, whereas bottom ash is, as the name suggests, removed from the bottom of the furnace. In the past, fly ash was generally released into the atmosphere via the smoke stack, but pollution control equipment mandated in recent decades now require that it be captured prior to release. It is generally stored on site at most US electric power generation facilities. Depending upon the source and makeup of the coal being burned, the components of the fly ash produced vary considerably, but all fly ash includes substantial amounts of silica (silicon dioxide, SiO_2) (both amorphous and crystalline) and lime (calcium oxide, CaO). Fly ash is commonly used to supplement Portland cement in concrete production, where it can bring both technological and economic benefits, and is increasingly finding use in synthesis of geopolymers and zeolites.

II. PROBLEM STATEMENT & METHODOLOGY

Problem Statement:
Now a day's construction of infrastructure and housing increases rapidly in our country. Due to this consumption of cement, coarse aggregate and fine aggregate increases day by

day, for manufacturing of these ingredients requires the natural recourses so due to this large amount of utilization natural recourses environmental imbalance takes place, due to this need of alternative materials essentially require to partially replacement of these ingredients. The effective use of natural and artificial waste can be best alternative for cement, coarse and fine aggregate.

Casting of Sample:

1.For the determination of compressive strength of concrete the mould of size 150x150x150 mm for M30grade of concrete are used It is cured for 3,7& 28 days.

2. For the determination of split tensile strength of concrete the specimen are casted of size 150mm dia.&300 mm ht. for M30grade of concrete are used It is cured for 3,7& 28 days.

3. The necessary precautions were taken during casting after 24 hrs all the specimens are remolded & curing was done under standard conditions.

III. RESULTS:

COMPRESSIVE STRENGTH

As per IS 516:1959, test specimens of size 150x150x150 mm were prepared for testing the compressive strength concrete. Fly Ash, coconut shell and glass with different proportion (10 %, 20%) added to concrete mix design for M 30 and different elements like a cube, cylinders, are casted. The rate of applied loading should be 140 kg/ cm^2 per minute. In this study, to make concrete, cement and fine aggregate are first mixed dry to uniform color and then coarse aggregate was added and mixed with the mixture of cement and fine aggregates. Water was then added and the whole mass mixed. The interior surface of the moulds and the base plate were oiled before concrete was placed. After 24 hours the specimens are removed from the moulds and placed in clean fresh water at a temperature of 27ºC. The specimens casted are tested after 3 days, 7 days and 28 days after curing. For testing in compression, no cushioning material was placed between the specimen and the plates of the machine. The load was applied axially without shock till the specimen was crushed. Results of the compressive strength test on concrete are as follow:

SPLIT TENSILE STRENGTH

Concrete is sufficient in strength only in one direction. The tensile strength of concrete is approximately one-tenth of the compressive strength and it is not generally used in the design of concrete structure. Nevertheless, it is an important property in many applications. The splitting indirect tensile is also known as the Brazil test, which developed originally in Brazil. The testing of specimens in pure tension is very difficult and usually determines by indirect mean, applying tension in the form of splitting. Concrete specimens for indirect tensile test were 150mm diameter and 300mm height. The specimens were placed with its axis horizontal, between the platens of a compression- testing machine. Load was applied until the specimen fails in its vertical diameter. The splitting test is simple to conduct and gives more consistent results than other tension tests. It is believed that the strength obtained by splitting test is near to that of the true tensile strength of the concrete than modulus of rupture. Tensile strength of a concrete is a measure of its ability to resist forces, which stretch or bend it. Unlike steel, the concrete is sufficient in strength only in one direction. The load shall be applied as per IS. 5816-1999 (reaffirmed 2004) without shock and increased continuously at a nominal rate within the range 1.2 N/ (mm^2/min) to 2.4 N/ (mm^2/min).Maintain the rate, once adjusted, until failure

CONVENTIONAL CONCRETE TEST RESULTS

Table.1. Result of Conventional Concrete

Sr No	Compressive Strength, MPa			Split Tensile Strength, MPa		
Days	3	7	28	3	7	28
1	15.1	23.4	37.3	1.7	2.5	3.7
2	14.7	24.2	38.1	1.74	2.52	3.6
3	14.9	23.9	37.1	1.79	2.9	3.7

Table.2. 10% Replacement of cs as coarse aggregate

Sr No	Compressive Strength, MPa			Split Tensile Strength, MPa		
Days	3	7	28	3	7	28
1	16.6	26.67	36.7	1.45	2.31	3.6
2	16.83	27.43	37.0	1.40	2.2	3.5
3	17.10	27.14	36.8	1.43	2.27	3.4

Table .3. 20% replacement of cs as coarse aggregate

Sr No	Compressive Strength, Mpa			Split Tensile Strength, MPa		
Days	3	7	28	3	7	28
1	17.34	25.01	34.7	1.32	1.96	3.5
2	18.02	25.42	34.9	1.28	1.98	3.2
3	18.47	24.78	32.8	1.33	2.34	3.3

Table .4.10% coconut shell aggregate + 10% fly ash + 10% glass replacement

Sr No	Compressive Strength, Mpa			Split Tensile Strength, MPa		
Days	3	7	28	3	7	28
1	17.34	24.7	37.3	1.8	2.6	3.7
2	17.89	24.98	37.9	1.82	2.8	3.8
3	18.53	24.6	37.5	1.89	2.67	3.85

Table.5. 10% coconut shell aggregate + 20% fly ash + 20% glass replacement

Sr No	Compressive Strength, MPa			Split Tensile Strength, MPa		
Days	3	7	28	3	7	28
1	17.92	24.2	37.7	1.78	2.5	3.76
2	17.84	24.6	38.0	1.76	2.4	3.5
3	17.81	24.33	37.6	1.76	2.6	3.72

M 30 Grade Concrete:

Comparison of results: (compressive sterngth)

Table.6. comparison of results, (compressive strength)

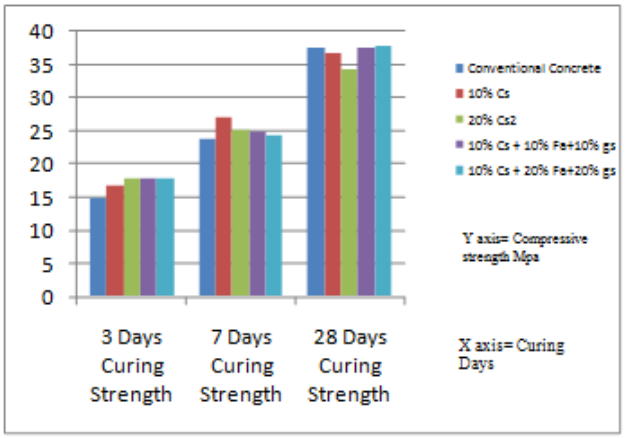
DAYS	CONVENTIONAL CONCRETE MPA	10% CS MPA	20% CS MPA	10% CS + 10% FA+10 % GS MPA	10% CS + 20% FA+20 %GS MPA
3 DAY	14.9	16.84	17.94	17.92	17.85
7 DAYS	23.83	27.08	25.07	24.76	24.37
28 DAYS	37.5	36.83	34.2	37.56	37.76

Comparison of results: (split tensile strength)

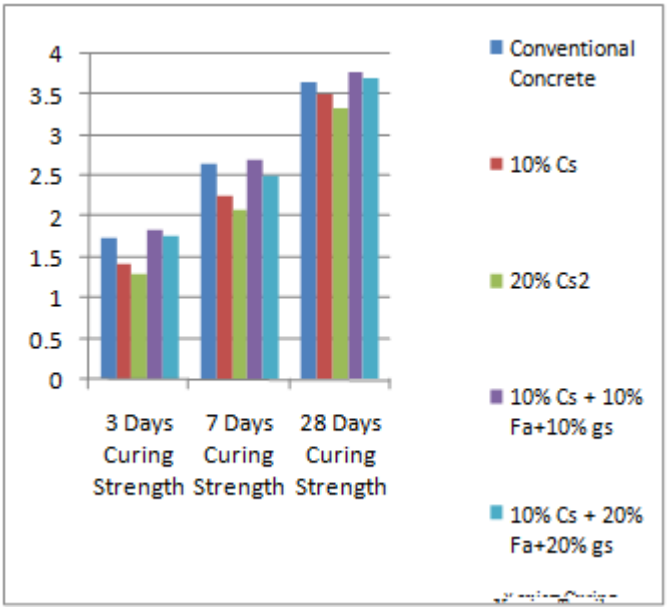
Table.7. comparison of results: (split tensile strength

DAYS	CONVENTIONAL CONCRETE MPA	10% CS MPA	20% CS MPA	10% CS + 10% FLYASH+10 %GS MPA	10% CS + 20% FLYASH+20 %GS MPA
3 DAY	1.74	1.43	1.31	1.83	1.76
7 DAYS	2.64	2.26	2.09	2.69	2.5
28 DAYS	3.66	3.5	3.33	3.78	3.7

Graphs:



Graph.1. Comparison between Conventional Concrete and Modify concrete (Compressive Strength)



Graph.2. Comparison between Conventional Concrete and Modify concrete (Split tensile Strength)

IV. ECONOMIC ANALYSIS

Table.8. Cost Analysis of Conventional Concrete for 1Cubic Meter

Materials	Cost of Materials	Materials required	Cost
Cement	Rs 270/ Bag	428 kg	2311
Crushed Sand	Rs 2900/ Brass	959 kg / 0.19 Brass	551
Coarse Aggregate	Rs 2400 / Brass	992 kg/0.20 brass	480
Labour Charges	Rs 350 (tentative)	3 Labours	1100
Equipment Charges	Rs 600 (tentative)	-	600
TOTAL			**5042/-**

Table.9. Cost Analysis of Modify Concrete for 1Cubic Meter

Materials	Cost of Materials	Materials required	Cost
Cement	Rs 270/ Bag	385 kg	2079
Fly Ash	Rs 1 / Kg	42 kg	42
Crushed Sand	Rs 2900/ Brass	863 kg/0.17	493
Waste Glass	-	95 kg/	-- -
Coarse Aggregate	Rs 2400 / Brass	893 kg/0.18	437
Coconut Shell	-	99 kg	--
Labour Charges	Rs 350 (Tentative)	3 lobours	1100
Equipment Charges	Rs 600(tentative)		600
TOTAL			**4751/-**

V. CONCLUSION

Results of experiments on compressive strength, split tensile strength, for the replacement of different percentage of coconut shells concretes are presented with the conventional

concrete. However, performance of coconut shells aggregate concrete having a marginal variation than conventional aggregate concrete. The main points of this study are:

1. The partial replacement of coconut shells in place of aggregates, 10% & 20% replacement has decreased marginally the strength properties of concrete compared to the conventional concrete.
2. The partial replacement of coconut shells as coarse aggregates and replacement of fly ash as cement increase the strength properties of concrete compared to the conventional concrete.
3. The replacement of the 10%coconut shells as coarse aggregate decreases the marginal value of 0.67% in compression strength and 0.16% in split tensile strength.
4. The replacement of the 20%coconut shells as coarse aggregate decreases the marginal value of 3.3% in compression strength and 0.33% in split tensile strength.
5. The replacement of the 10%coconut shells as coarse aggregate and 10%fly ash as a cement and 10% glass powder as fine aggregate increases the marginal value of 0.06% in compression strength and increase of 0.12% in split tensile strength.
6. The replacement of the 10%coconut shells as coarse aggregate and 20%fly ash as a cement and 20% glass as fine aggregate increases the marginal value of 0.26% in compression strength and increase of 0.1% in split tensile strength.
7. The compressive strength of concrete increase with increase in percentage of coconut shell percentage.
8. The replacement of Coconut shell as Coarse aggregate and Fly ash as Cement and Glass as Fine aggregate increase the compressive strength of concrete
9. Total 5 % manufacturing cost of modify concrete less than conventional concrete, so use of modify concrete is economical.

VI. ACKNOWLEDGEMENT

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VII. REFERENCES

[1]. K. Gunasekarn, P.S. Kumar, M. Lakshmipathy" Mechanical and bond properties of coconut shell concrete, Elsevier Construction and Building Materials 25 (2011) 92–98

[2]. K. Gunasekaran a, R. Annadurai a P.S. Kumar "Long term study on compressive and bond strength of coconut shell aggregate concrete, Elsevier Construction and Building Materials 28 (2012) 208-2015

[3]. A. Jaya prithika S.K. Sekar," Mechanical and fracture characteristics of Eco-friendly concrete produced using coconut shell, ground granulated blast furnace slag and manufactured sand" , Elsevier Construction and Building Materials 103 (2016) 1-7

[4].A. Jaya prithika S.K. Sekar," Stress-strain characteristics and flexural behavior of reinforced Eco-friendly coconut shell concrete", Elsevier Construction and Building Materials 117 (2016) 244-250

[5].K. Gunasekaran R. Annadurai, S. Prakash Chandar, S. Anandh," Study for the relevance of coconut shell aggregate concrete non-pressure pipe" Ain Shams Engineering Journal (2016) 1-8

[6].S.P. Gautam, Vikas Srivastava and V.C. Agarwal," Use of glass wastes as fine aggregate in Concrete" J. Acad. Indus. Res. Vol. 1(6) November 2012,320-323

[7].Majid Ali Xiaoyang Li, Nawawi Chouw,"Experimental investigations on bond strength between coconut fibre and concrete", Elsevier Construction and Building Materials 44 (2013) 596-605

[8].Majid Ali Xiaoyang Li, Nawawi Chouw,"Experimental investigations on bond strength between coconut fibre and concrete", Elsevier Construction and Building Materials 44 (2013) 596-605

[9].Vishwas P. Kukarni, Sanjay kumar B. Gaikwad, 2013, "Comparative Study on Coconut Shell Aggregate with Conventional Concrete", International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 12

[10].Ahmad Shayan, 2002, "Value-added Utilisation of Waste Glass in Concrete", IABSE SYMPOSIUM MELBOURNE

[11]. Akshay S. Shelke, Pooja P. Kunjekar, 2014, "Coconut Shell as Partial Replacement for Coarse Aggregate", International Journal of Civil Engineering Research, ISSN 227 8-3652 Volume 5, Number, pp. 211-214.

[12]. Daniel Yaw Osei, 2013, "Experimental assessment on coconut shells as aggregate in concrete", International Journal of Engineering Science Invention, Volume 2 Issue 5 ǁ PP.07-11.

[13].Dewanshu Ahlawat, L.G. Kalurkar, "Coconut Shell as Partial Replacement of Coarse Aggregate in Concrete", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), PP 61-64.

[14].Dr. Haider K. Ammash, Muhammed S. Muhammed, Ali H. Nahhab, 2009, " USING OF WASTE GLASS AS FINE AGGREGATE IN CONCRETE", Al-Qadisiya Journal For Engineering Sciences Vol. 2.

[15]. Liang & Hong, 2007, "USE OF WASTE GLASS AS AGGREGATE IN CONCRETE", UK Chinese Association of Resources and Environment Greenwich.

[16].S.P. Gautam, Vikas Srivastava and V.C. Agarwal', 2012, "Use of glass wastes as fine aggregate in Concrete", J. Acad. Indus. Res. Vol. 1(6)

[17].Vishwas P. Kukarni, Sanjay kumar B. Gaikwad, 2013, "*Comparative Study on Coconut Shell Aggregate with Conventional Concrete*", International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 12

[18]. Vinod Goud and Niraj Soni ," Partial Replacement of Cement with Fly Ash in Concrete and its Effects" IOSRJEN – ISOR Journal of Engineering | Volume 06 | Issue 10 | Oct 2016

[18].Gopal Charan Behera and Ranjan Kumar Behera(2013)"A exploratory study of coconut shell as coarse aggregate in concrete", Journal of Engineering and Applied Sciences

[20]. Gunasekaran, P.S. Kumar et al 2008, "Proceedings of International Conference on Advances in Concrete and Construction, ICACC-2008", 2008, Hyderabad, India pp 450-459

[21]. Vishwas P. Kukarni, Sanjay kumar B. Gaikwad (2013) "Comparative Study on Coconut Shell Aggregate with Conventional Concrete "Certified International Journal of Engineering and Innovative Technology (IJEIT) Volume 2