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A PARTIAL REPLACEMENT FOR COARSE AGGREGATE BY SEASHELL AND CEMENT BY FLYASH IN CONCRETE

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Abstract*-In developing countries where concrete is widely used, the high and steadily increasing cost of concrete has made construction very expensive. This, coupled with the deleterious effect of concrete production on the environment has led to studies on various materials which could be used as partial replacement for coarse aggregate and cement.This project is experimented to reduce the cost of concrete.In this research work experiments have been conducted with collection of materials required and the data required for mix design are obtained by sieve analysis and specific gravity test. Sieve analysis is carried out from various fine aggregates (FA) and coarse aggregates (CA) samples and the sample which suits the requirement is selected. Specific gravity tests are carried out for fine and coarse aggregate. In this project, cement is replaced with fly ash of about 25% along with the partial replacement of coarse aggregate with seashell. The coarse aggregate is replaced with 10 %, 20%, and 30% by seashell. The design mix used to execute this project is M20 grade concrete. This M20 grade concrete is designed as per Indian Standard Code for both the conventional concrete and seashell concrete. The water cement ratio is maintained for this mix design is 0.5. Preliminary test comprising sieve analysis, specific gravity, consistency, setting time and soundness were conducted.workability and strength test were also carried out on fresh and hardened concrete made from the study material. The strength obtained from seashellconcrete is compared with the conventional concrete. Finally to compare both normal concrete and conventional concrete. Thus, 10%, 20% replacement of seashell are recommended for conventional concrete to increase the strength of concrete and slightly decreased by 30% strength of concrete to compare the normal concrete.

Keywords: cement, aggregate, fly ash, seashell (ss).

I.INTRODUCTION

As concrete is ubiquitous and its history can be traced to ancient Egypt and Rome, it is often falsely perceived as a "simple" material. Actually, the microstructure of concrete tends to be highly complex. Moreover, the structure and the properties of this composite material can change over time. Most modern concrete structures are reinforced with steel, since concrete itself displays relatively low strength when loaded in tension. While steel reinforced concrete is obviously a widely used, cost-effective construction material, degradation of such structures has become a major problem in many parts of the world. The basic constituents of concrete are cement, water and aggregate (and selected additives). Cement is produced by heating limestone and clay to very high temperatures in a rotating kiln. Cement is produced by grinding the resulting clinker to a fine powder. Water reacts chemically with cement to form the cement paste, which essentially acts as the "glue" (or binder) holding the aggregate together. The reaction is an exothermic hydration reaction. The water cement ratio is an important variable that needs to be "optimized". High ratios produce relatively porous concrete of low strength, whereas too low a ratio will tend to make the mix unworkable. Aggregates are usually described as inert "filler" material of either the fine (sand) or coarse (stone) variety. Aggregate tends to represent a relatively high volume percentage of concrete, to minimize costs of the material. Recent investigation of Indian sea shells has indicated greater scope for their utilization as a construction material. Greater utilization of sea shells will lead to not only saving such construction material but also assists in solving the problem of disposal of this waste product. In present generation as the population is increasing rapidly and construction work is also increasing so to replace the old process the new bricks like fly ash bricks came in to field replacing the old lime bricks, whereas the cementing material like mud, lime paste and gums is replaced by the Cement of different kinds in different construction. As the status of living is increasing their needs for maintenance is also increasing more structures and more vivid types of structures have come to world. So the need for the replacement of the present material that is the concrete manufacturing has to be changed to meet the needs of the structures. So the most economical, ecological, light – weight and increasing the ease of work construction of the structure is important in the present economy. So the role of the light – weight concrete has come into the field. As modern engineering practices become more demanding, there is a corresponding need for special types of materials with novel properties. Scientists, engineers and technologists are continuously on the searching for materials, which can act as substitute for conventional materials or which possess such properties as would enable new designs and innovations resulting in to economy, so that a structure can be built economically. Many attempts have been made to develop new materials, which is the combination of two or more materials. Such materials are called composite materials. Concrete can be concluded as a composite material as it is a mixture of different materials. For reducing the cost of concrete, greater use of pozzolanic materials like fly ash and blast furnace slag was suggested for the cement, sea shells, glass and ceramic material are used in case of fine aggregates, when coming to case of course aggregates palm kernel shells, coconut shells and sea shells. The use of these materials as the substitute material in concrete would reduce the disposal problem now faced by thermal power plants and industrial plants, agricultural areas and at the same time achieving the required strength of concrete. Already many investigations have been going on the partial replacement of coconut shells in place of coarse aggregate. In the present investigation sea shells has been used as partial replacement of coarse aggregate and cement by fly ash. Seashells are also available in large quantities.**Tan et al [1]** He analyzed that the Supplementary materials such as fly ash, slag and silica fume when used in concrete production have been found to be beneficial in improving several properties including strength (as a result of pozzolanic reaction) and permeability (as a result of reduction in porosity and refinement of the microstructure) thereby reducing ingress of water and other harmful salt solutions and in many cases reducing the overall production cost. Strength improvements due to the addition of mineral admixtures is due to the pozzolanic reaction taking place, which typically starts after seven days and causes in increase in the amounts of C-S-H gel which is known to be the strength imparting component in concrete. Studies have also shown that a combination of fly ash and slag improves the strength of concrete at all ages similar to the addition of silica fume. **Gunasegaram[2]** studied the properties of concrete using coconut shell as coarse aggregate were investigated in an experimental study. Compressive, flexural, splitting tensile strengths, impact resistance and bond strength were measured and compared with the theoretical values as recommended by the standards. The bond properties were determined through pull-out test. Coconut shell concrete can be classified under structural lightweight concrete.**O.T. Olateju [3]** in his paper reports the exploratory study on the suitability of the periwinkle shells as partial or in concrete works. Physical and mechanical properties of periwinkle shell and crushed granite were determined and compared. A total of 300 concrete cubes of size 150 × 150 ×150 mm with different percentages by weight of crushed granite to periwinkle shells as coarse aggregate in the order 100:0, 75:25, 50:50, 25:75 and 0:100 were cast, tested and their physical and mechanical properties determined. A.**P. Adewuyi and T. Adegoke[4]** Concluded The strength of periwinkle shell concrete is determined based on the properties of the shells and various percentage replacements; Concrete with 35.4% and 42.5% periwinkle shells inclusion can still give the minimum 28-day cube strength values of 21 N/mm2 and 15 N/mm2 expected for concrete mixes 1:2:4 and 1:3:6, respectively. Concrete having up to 50% periwinkle shells inclusion can still be regarded as normal weight concrete. Savings of about 14.8% and 17.5% can be achieved by adopting 35.4% and 42.5% periwinkle inclusion for 1:2:4 and 1:3:6 concrete mixes, respectively. **Nasser et al**He analyzed that lower replacement levels of cement with fly ash or slag in the range of 20-35% is optimum in order to have satisfactory durability to frost conditions. Concrete with higher water to binder (w/b) ratio is more susceptible to problems related to deicer salt scaling and internal micro cracking due to freeze and thaw cycles. Also, problems of dispersion of the air-entraining agents due to high carbon contents in the fly ash have been reported. Researchers have argued that as long as sufficient air content and spacing factor is provided, high carbon contents in fly ash do not pose a problem. .[6] discussed about Microwave Semiconductor Devices such as Tunnel diode, Gunn diode and valanche transit time devices and analyzes Monolithic Microwave Integrated Circuits (MMIC)

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II.EXPERIMENTAL SETUP

In this stage collection of materials required and the data required for mix design are obtained by sieve analysis and specific gravity test. Sieve analysis is carried out from various fine aggregates (FA) and coarse aggregates (CA) samples and the sample which suits the requirement is selected. Specific gravity tests are carried out for fine and coarse aggregate. The various materials used were tested as per Indian standard specifications.

II.1 Materials

Raw materials required for the concreting operations of the present work are cement, fine aggregate, coarse aggregate, fly ash, seashell and water.

Cement: The most common cement used is an ordinary Portland cement. The Ordinary Portland Cement of 53 grade conforming to IS: 12269-1987 is been used. Many tests were conducted on cement; some of them are Specific gravity, setting tests, etc.

II.2

S.No.	property	test results.
1	Normal consistency	28%
2	Specific gravity	3.15
3	Initial setting time	27 min
4	Final setting time	535 min

II**.3Fly ash:** Fly ash is a finely divided residue resulting from the combustion of powdered coal and transported by the flue gases and collected by the electrostatic precipitator. In recent time the importance and use of fly ash in concrete has grown so much that it has almost become the common ingredient in concrete particularly for making high strength and high performance concrete.
Specific gravity of fly ash is 2.2

II.4 Aggregate: The size of aggregates used is 20mm and the grain size of sand used is of zone 2. The aggregate tests are performed and the results are as follows.

Sieve Analysis: The sieve analysis test is performed to obtain a distribution of grain size of the aggregate. The test was performed for 20mm aggregates, river sand and seashell for the project.

Fine Aggregate: The sieve analysis for fine aggregate is done to find out the grain size of the sand and its zone. The analysis is done with 500 grams of sand in an automatic sieve shaker for about 5 minutes with the sieve dishes are arranged from 10 mm to 150 microns down the order of sieve shaker. Based on the analysis the fineness modulus obtained is 2.46. Specific gravity of fine aggregate is 2.51.

According to IS 2386 – 1963, Fineness modulus ranges are
Fine sand : 2.2 – 2.6
Medium sand: 2.6 – 2.9
Coarse sand : 2.9 – 3.2

Coarse Aggregate: The sieve analysis for coarse aggregate is executed to find out the aggregate size and its zone. The fractions from 80 mm to 4.75 mm are termed as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, conforming to IS 383 – 1970 is been used. The analysis is done with 5 Kg of coarse aggregate by manual sieve shaker for about 15 minutes with the sieve dishes are arranged from 40 mm to 150 microns down the order of sieve shaker. Based on the analysis, the fineness modulus obtained as 7.132 which is in zone – II conforming to IS 383 – 1970. Specific gravity of coarse aggregate is 2.67.

II.5 Seashell: Seashell is a waste obtained near the seashore area as the result of disintegration of dead animals. Seashell consists of three layers outer, intermediate and inner layer .Outer layer is made up of calcite material whereas inner layer is otherwise known as nacre which is made up of calcium carbonate. Since 95% of calcium carbonate present in seashell, it has the strength nearly equal to coarse aggregate. The sieve analysis for seashell is executed to find out its size. The analysis is done with 500 grams of seashell bymanual sieve shaker for about 15 minutes with the sieve dishes are arranged from 40 mm to 1.18 mm down the order of sieve shaker. Based on the analysis, the fineness modulus obtained as 7.53.Specific gravity of seashell is 2.50.

II.6 Water Absorption Test: This test is performed in order to determine the water absorption capacity of the aggregates used. Here about 300 grams of the various aggregates are taken separately and immersed in water for about 24 hours. These aggregates are then kept in oven at a temperature of 100 to 110 C° for a time period of 6 hours and then sample is weighted. The change in weight is noted. As per code the limiting value for the water absorption is 2%. The results of the aggregates tested are

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1% for sand, 0.5% for 20mm aggregates and 0% for seashell.

II.7 Slump Test: The aim of this test is to determine the workability of the cement concrete to be used. The mix is prepared and placed in a clean slump cone mould and tamped by three layers of about 25 stokes each layer and the top of the cone is levelled off. Then the mould is lifted up vertically and the nature of slump is analyzed to get the workability of the given cement concrete. For the water cement ratio of 0.5 the slump obtained for each seashell concrete design mix and conventional design mix are given below (in mm):

Conventional concrete : 27
10 % replacement of seashell : 29
20 % replacement of seashell : 33
30 % replacement of seashell : 35

The above slump value are within the permissible limit as per IS code 456 and suitable for construction purpose and also has a good workability.

II.8 Compressive Strength of Concrete Cubes: This test is done to determine the cube strength of concrete mix prepared. The test is conducted on the 7th day and the 28th day and its observation are listed below in the form of a graph. Compressive strength values with replacement for coarse aggregates by seashell with 10%, 20%, 30% and cement by fly ash with 25%.

II.9 Tensile strength of cylinder: This test is done to determine the tensile strength of the cylinders. The test is conducted on the 7th day and the 28th day and its observation are listed below in the form of a graph. The cylinder is placed in a horizontal position and the load is applied gradually and value is recorded if the cylinder splits into two half or if the cylinder fails while applying the load on it.Tensile strength values with replacement for coarse aggregates by seashell with 10%, 20%, 30% and cement by fly ash with 25%.

III.Figures and Tables

Figure 1 Compression Testing of Cubes

The load is given gradually and the point where the cube fails is noted and it is taken as the load at which failure occurs.

S.no	% Replacement of fly ash and seashell	Compressive strength N/mm^2 (7 days)	Compressive e strength N/mm^2 (28days)
1	0	22	27
2	10	24	29
3	20	24.5	29.5
4	30	20	25

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Figure 2 Tensile testing of cylinder

Figure 4cubes and cylinder of concrete replaced with fly ash and sea shells aggregate

Figure 3seashell

Table 1:Compressive Strength Results

Table 2:Tensile Strength Results

S.no	% Replacement of fly ash and seashell	Split tensile strength N/mm^2 (7days)	Split tensile strength N/mm^2 (28days)
1	0	2.6	2.8
2	10	2.8	2.9
3	20	2.9	2.95
4	30	2.5	2.5

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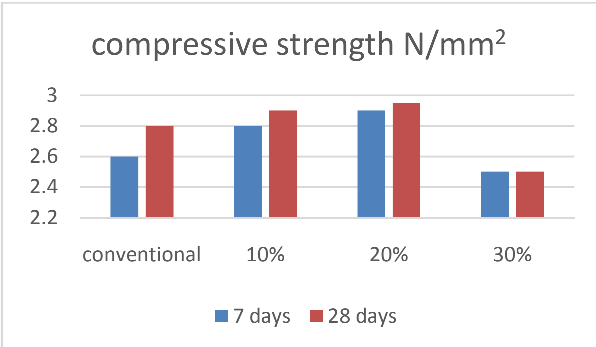
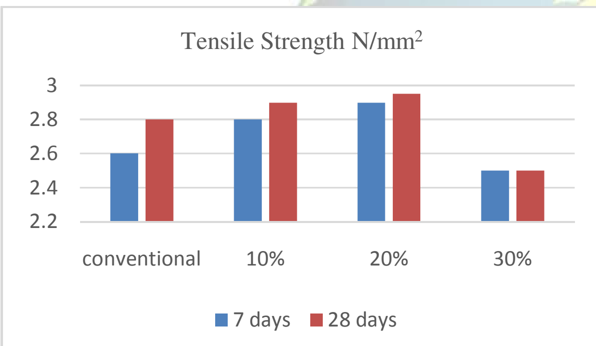


Graph1: Representation of Compressive Strength Values.



Graph2: Representation of Tensile Strength Values.

IV RESULT AND DISCUSSION

The above chart shows that compressive and tensile strength of concrete at 7 days and 28 days decreases gradually as the percentage of replacement increases. However, replacement by 10% and 20% is found to be more than the conventional concrete and 30% replacement is found much slightly lower than expected.

V.CONCLUSION

In this project we tried to replace the cement and coarse aggregate partially by fly ash (25%) and seashell (10%, 20%, & 30%) respectively to increase the strength of concrete. But the strength is same with the conventional concrete only at 10% and 20% replacement of aggregate by sea shell .The strength is gradually decreasing at 30% replacement of seashell.So we conclude that the cement and coarse aggregate replaced with fly ash at 25% and sea shell at 10% in concrete is suitable for construction. Moreover it reduces the construction cost by reducing the cost of cement and coarse aggregate and it also reduces the environmental pollution due to fly ash and seashell.

REFERENCES

[1] Olateju,(1992) *The efficacy of lightweight aggregate from palm kernel shells*", *Journal of Housing Science (4), pp. 263–276.*

[2] *Exploratory Study of Periwinkle Shells as Coarse Aggregates in Concrete Works*" A. P. Adewuyi and T. Adegoke -*ARPN Journal of Engineering and Applied Sciences, December 2008.*

[3] Adewuyi, A. P., Adegoke, T. 2008. Exploratory Study Of Periwinkle Shells As Coarse Aggregate In Concrete Works. *Journal of Applied Sciences Research*, 4(12): 1678-1681.

[4] Adewuyi A. P. and Adegoke T. 2008. Exploratory Study of Periwinkle Shells as Coarse Aggregate in Concrete Works. Journal Science Resources. 4(12): 1678-1681.

[5] Shetty M.S. "Concrete Technology Theory and Practice" S.Chand& Company New Delhi.

[6] Christo Ananth, "A Brief Outline on Microwave Semiconductor Devices [RF & Microwave Engineering Book 4]", Kindle Edition, USA, ASIN: B06XRY3835, ISBN: 978-15-208-929-1-7, Volume 11, March 2017, pp:129-192.

[7] Abbott, R. Tucker, 1986, *Seashells of North America*, St. Martin's Press, New York.

[8] Kamang, E. E. and O. F. Job (1997).The relationship between the strength and non-destructive parameters of periwinkle shell concrete. *African Journal of Natural Sciences*, 1:96-100.

[9] Osadebe, N. N., and O. M. Ibearugbulem (2009).Application of scheffe's simplex model in optimizing compressive strength of periwinkle shell granite concrete.*The Heartland Engineer*, 4 (1): 27 – 38.