EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT BY GROUNDNUT SHELL ASH IN CONCRETE

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ABSTRACT

This study investigates the use of considerable volume of groundnut shell ash as the partial replacement for cement in concrete production. 7, 28 days and the compressive strength and density determined. The percentage replacement of Ordinary Portland Cement (OPC) varies to the control (0% replacement) about 15%. The results generally show a decrease in density and compressive strength as the percentage replacement with GSA increases suggesting less hydration with cement. Based on a general analysis of the results as well as the logical comparison to the acceptable standard, a percentage replacement of 10% is suggested for sustainable construction, especially in mass concrete construction.

INTRODUCTION

1.1 General

The continuous increase in the price of Portland cement is attributed to the insufficient production rate of the raw materials when compared with the demand rate in the construction industries. During and after the harvest of groundnut the shell is regard as waste product which when accumulated in large quality in a particular are will constitute an environmental hazard.

Therefore the utilization of ground nut shell ash reduces the environmental problem resulting from the accumulation of the shells in a large quality in a particular area. In recent time, the knowledge of natural pozzolanas materials use as partial replacement for cement has increased substantially. The literature is reach and various research papers are available which have indicated various advantages in the use of pozzolanas in concrete production however, it has been show that the hydration process of concrete is showed down by the addition of these substitutes and again the early stage strength is reduced in comparison with normal ordinary Portland cement concrete(OPC) at present time, issues related to environmental conservation have gained importance, hence utilization of these waste materials that are available in our environmental in now necessary replacement level 0-50% was carried out by and comparing the strength property with which recommends that cement partially replaced with pozzolanas should reach a compressive strength of 65% to95% of the control specimen in 28 days and hence optimum replacement of 20%recommended.

LITERATURE REVIEW

ABDULLAHI, etc. all have studied in this paper about the groundnut shell ash to increase the load carrying a capacity of concrete member and reduce the brittleness of concrete and improve its engineering properties such as tensile, flexural, impact resistance, fatigue and load carrying capacity after cracking and toughness by using the groundnut shell ash volume fraction (5.10, 15). At a curing period for 28 days test result.

OLUREMI, etc. have studied in this paper

about the concrete is good in compression but weak in tension that is, concrete is brittle material. So, in order to improve the tensile short groundnut shell ashes are used. The main objectives of these studies are effects of groundnut shell ash on flexural performance of reinforced concrete by using a steel fiber volume fraction 5, 10, 15%.

OYETOLAE.B AND ABDULLAHI, etc. all have studied in this paper about the most application of groundnut shell ash reinforced concrete in civil construction is the most proper due to its improvement in resistance to cracking, fatigue, abrasion, impact, durability and conventional reinforced concrete by using a groundnut shell ash volume (5, 10, 15%) of groundnut shell ash.

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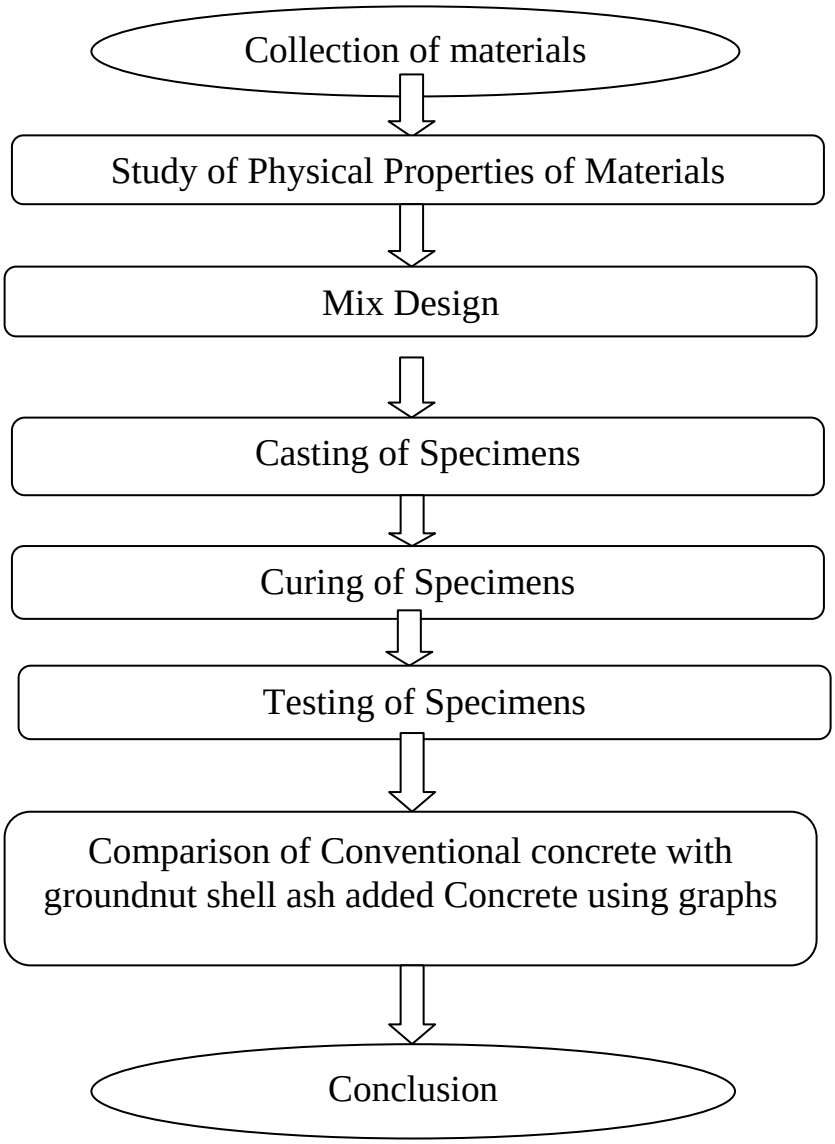
METHODLOGY

3.1 METHODOLOGY OF THE PROJET



MIX DESIGN

4.1 MIX DESIGN FOR CONCRETE:

- The grade of concrete used here is M20.
- The ratio for M20 is 1:1.5:3.

4.1.1 Mix design for cube:

Volume of cement : 1.47kg
Volume of fine aggregate : 2.209kg
Volume of coarse aggregate : 4.418kg
Water-cement ratio : 0.736litre

4.1.2 Mix design for cylinder:

Volume of cement : 2.313kg

Volume of fine aggregate : 3.469kg
Volume of coarse aggregate : 6.938kg
Water-cement ratio : 1.156litre

4.1.3 Mix design for prism:

Volume of cement : 6.545kg
Volume of fine aggregate : 9.81kg
Volume of coarse aggregate : 25kg
Water-cement ratio : 3.27litre

MATERIALS

5.1 MATERIALS INVOLVED:

The materials involved in this project are as follows with their respective test results.

i. Cement
ii. Coarse Aggregate
iii. Fine Aggregate
iv. Groundnut shell ash

5.2 CEMENT

Cement is a binding material. The history of cementing material is as old as the history of engineering construction. Ordinary Portland cement is far the most important type of cement. The OPC classified into three grades, namely 33 grade, 43 grade and 53 grade depending upon the strength of the cement at 28 days when tested as per IS 4031-1988. If 28day strength is not less than 33N/mm^2 it is called 33 grade cement, if the strength is not less than 43N/mm^2, it is called 43 grade cement, and the strength is not less than 53N/mm^2, it is called 53 grade cement. But the actual strength obtained by these cements at the factory is much higher than the BIS specification. The raw materials used for the manufacture of cement consist mainly of lime, silica, alumina and iron oxide.

5.3 COURSE AGGREGATE:

The aggregates which are retained on the 4.75mm IS sieve is known as the coarse aggregate. The properties of coarse aggregates are decided by the strength of the concrete. Therefore the aggregate should be free from the minerals and chemical impurities. Crushed aggregate with specific gravity of 2.60 and passing through 20mm sieve and retained on 12mm will be used for casting all specimens. The selection of coarse aggregate contains many properties to be considered. The specific gravity, water absorption, grain size distribution are to be found in the laboratory.

5.4FINE AGGREGATE:

Sand between 0.50 mm and 4.75 mm is called as fine aggregate. Fine aggregate consists of natural sand, crushed sand or crushed gravel stone dust. The sand used for casting the specimen is natural river sand. It should be hard, durable chemically inert, clean and free from organic matter. Very fine sand is not recommended for structural concrete. Very fine sand shows difficulties in surface finishing of concrete but provides good strength and more cohesion. The fine aggregate used for casting was sieved through IS 4.75mm sieve.

5.5 WATER

It is the least expensive but most important ingredient of concrete. It plays an important role in mixing, laying, compacting, setting and hardening of concrete. It influences the strength and durability of concrete. Water influences the strength development and durability of concrete. The p^H value of water shall generally be not less than 6.portable water available in the laboratory was used for making concrete.

5.5 PROCESS GROUNDNUT SHELLASH

PROPERTIE OF HARDENED CONCRETE

6.1 TESTS ON HARDENED CONCRETE:
The tests done on hardened Concrete are as follows

I) Compressive strength on cube
II) Split Tensile strength on cylinder
III) Flexural strength on Prism

6.2 COMPRESSIVE TEST ON CUBE:

Out of many tests carried out in concrete, this is the utmost important which gives us an idea about all characteristics of concrete.

6.3 SPLIT TENSILE STRENGTH OF CYLINDER

Concrete is strong in compression but week in tension. Tensile stresses are likely to develop in concrete due to drying shrinkage, rusting of steel reinforcement, temperature gradient etc.

COMPRESSIVE TEST MACHINE

6.4FLEXURAL STRENGTH OF PRISM:

Out of many tests carried out in concrete, this is the utmost important test which gives us an idea about strength of prisms

FLEXURAL STRENGTH TEST MACHINE

CASTING OF CONVENTIONAL CONCRETE

7.1MIXING:

I. The cement of M33 grade is chosen with the mix ratio M20.
II. Totally 3 cube is casted to calculate the ultimate strength in the cube.
III. For the cubes, the curing period will be
    a. 7 days
    b. 28 days
IV. The net weight of the cement for one cube is 1.473kg
V. Whereas the weight of fine aggregate will be 2.209kg and the weight of coarse aggregate will be 4.148kg
VI. The water- cement ratio for each cube is 736.5ml.
VII. After casting the cube, the would is kept aside for 1 day after that thewould is immersed in water.

7.2 CURING:

I. After 7 days of casting, the cube is taken out and made to dry for 24hours
II. Then the cube is subjected to compressive strength of concrete.
III. Likewise 28 days strength is also calculated.
IV. This method is common to both cylinder and prism.

7.3MIXING:

VIII. The cement of M33 grade is chosen with the mix ratio M20.
IX. Totally 3 cube is casted to calculate the ultimate strength in the cube.

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7.4 TESTSON HARDENED CONCRETE:

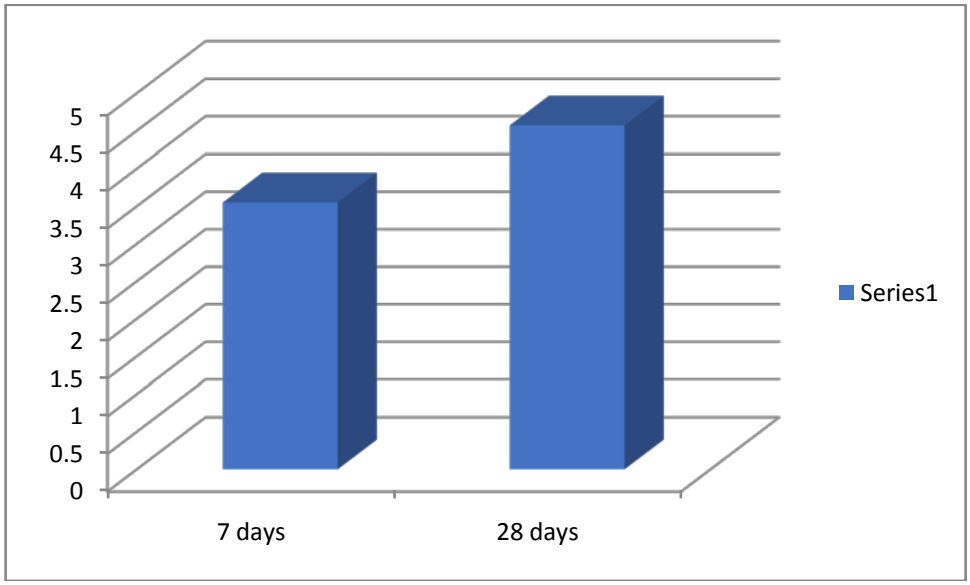
The tests done on hardened conventional concrete are as follows.

a. Compressive Test on cube
b. Split tensile Test on cylinder
c. Flexural strength on prism

COMPRESSIVE TEST ON CONVENTIONAL CUBE:

TABLE NO1: Compressive strength on cube:

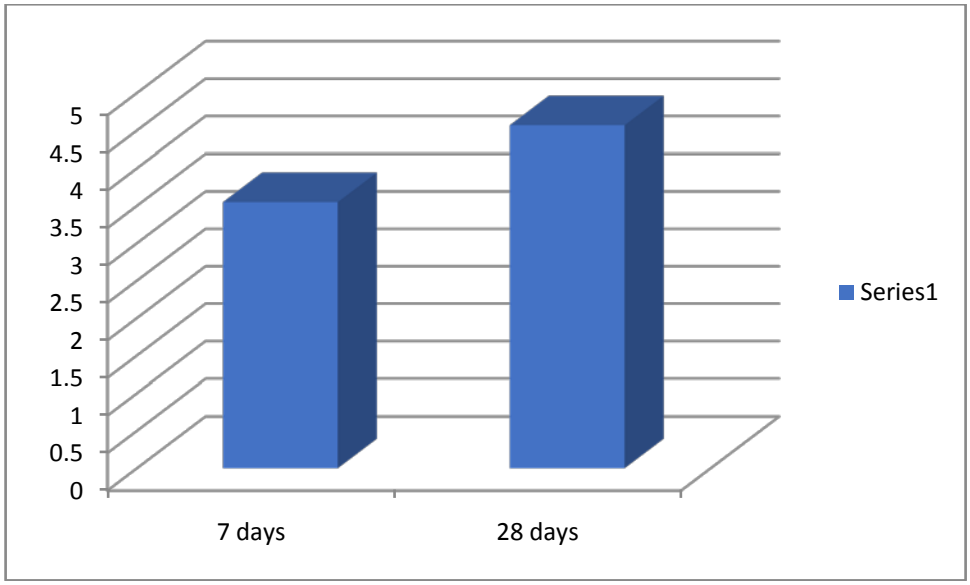
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive strength (N/mm^2)
1	1	7 days	220	9.77
2		28 days	740	32.88



SPLIT TENSILE TEST ON CONVENTIONAL CYLINDER:

TABLE NO1:Split tensile strength on cylinder:

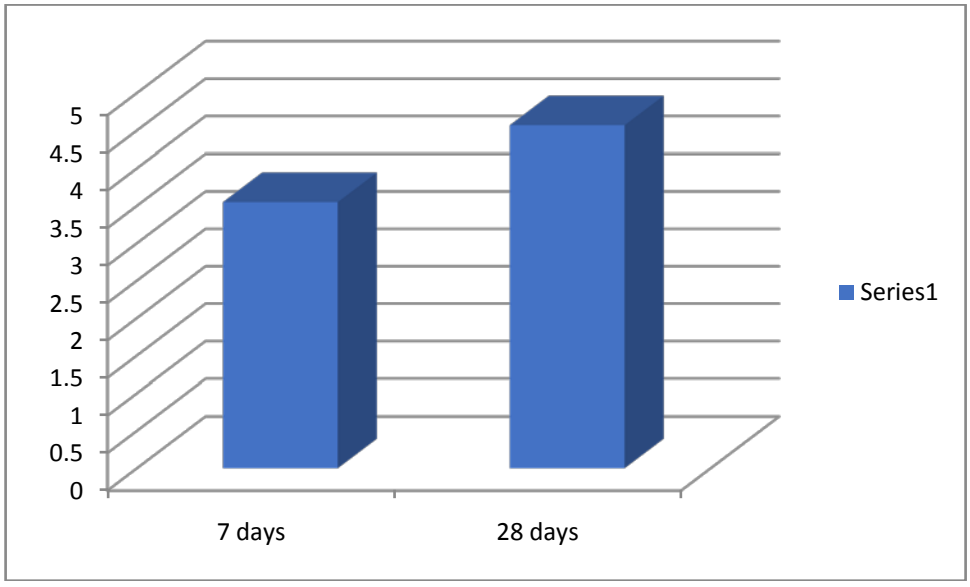
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive strength (N/mm^2)
1	1	7 days	155	2.19
2		28 days	220	3.11



FLEXURAL STRENGTH TEST ON CONVENTIONAL PRISM:

TABLE NO2: Flexural test on prism:

S.no	Sample no	Curing period	Load at failure(KN)	Average compressive strength (N/mm^2)
1	1	7 days	36	3.2
2		28 days	56	4.9

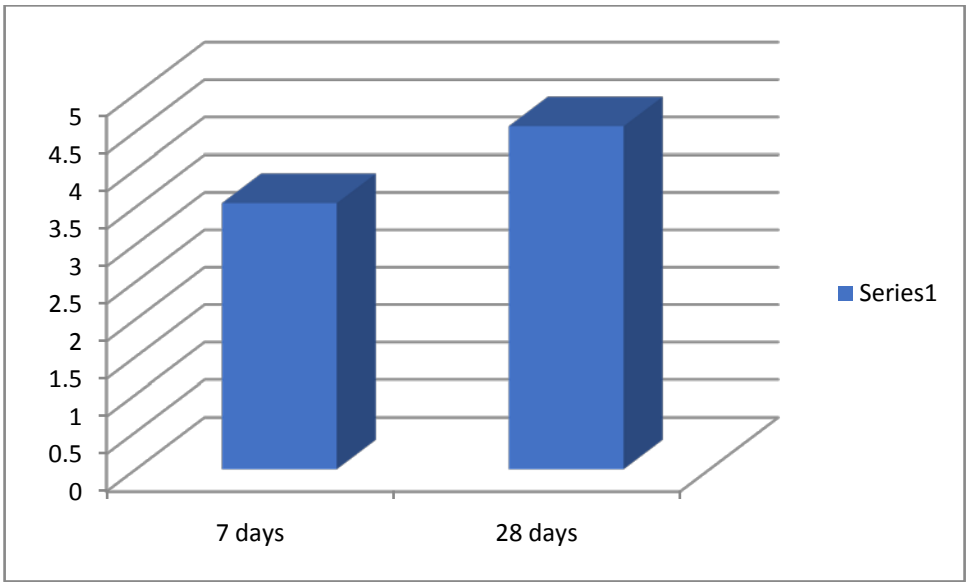


ADDITION OF GROUNDNUT SHELL ASH

8.1.2.1COMPRESSIVE TEST ON 5% GROUNDNUT SHELL ADDED CUBE:

TABLE NO4: Compressive strengthtest on cube:

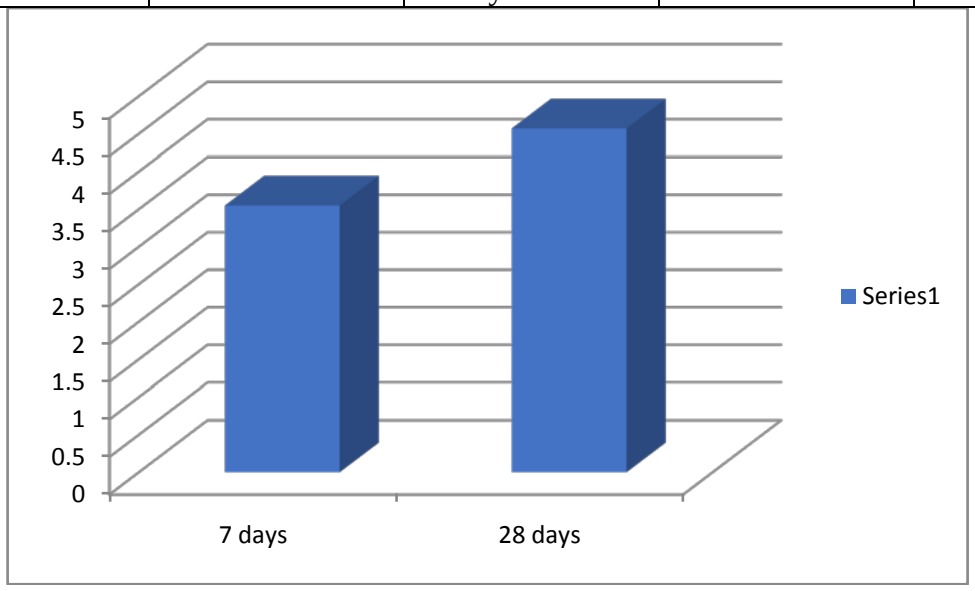
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	240	10.66
2		28 days	860	38.22



8.1.2.2 SPLIT TENSILE TEST ON 5% GROUNDNUT SHELL ADDED CYLINDER:

TABLE NO5: Split tensile test on cylinder:

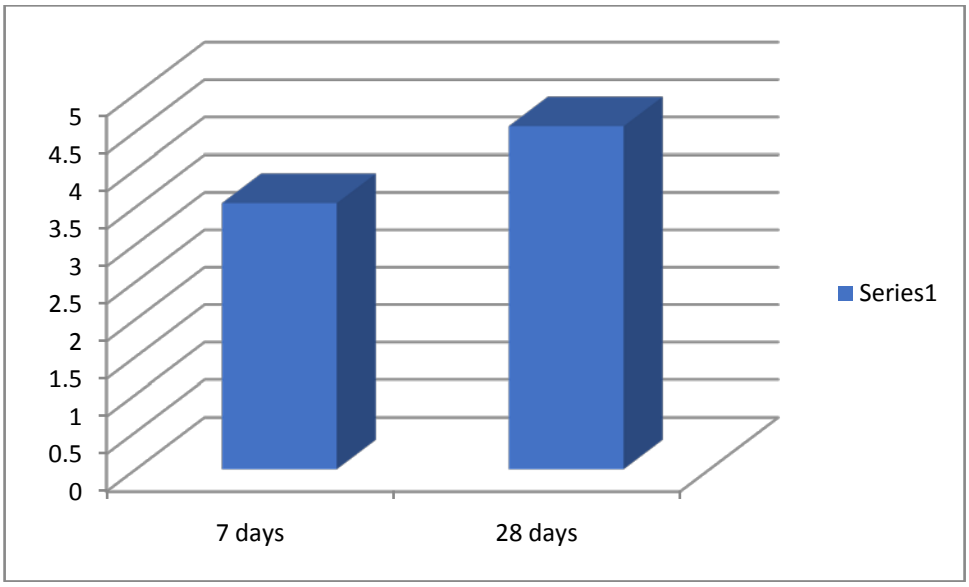
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	120	1.69
2		28 days	164	2.32



8.1.2.3 FLEXURAL STRENGTH ON 5% GROUNDNUT SHELL ADDED PRISM:

TABLE NO6: Flexural test on prism:

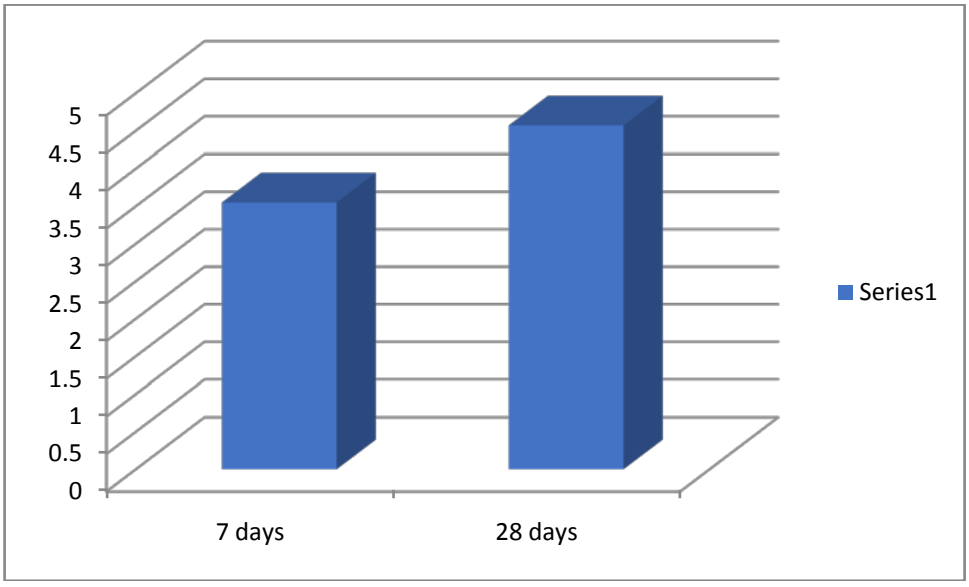
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	28	2.48
2		28 days	56	4.97



8.1.2.4COMPRESSIVE TEST ON 10% GROUNDNUT SHELL ADDED CUBE:

TABLE NO7: Compressive strength test on cube:

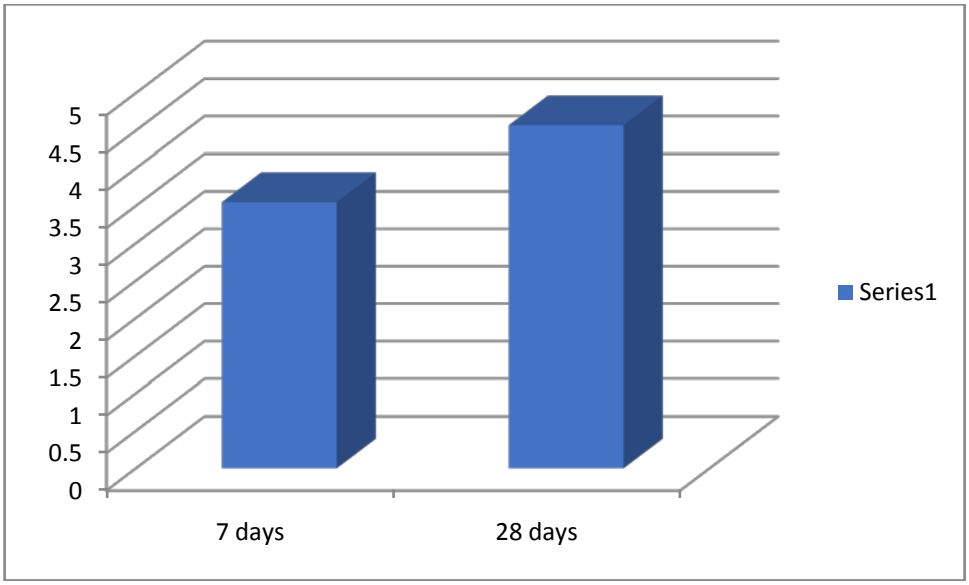
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	260	11.55
2		28 days	880	39.11



8.1.2.5 SPLIT TENSILE TEST ON 10% GROUNDNUT SHELL ADDED CYLINDER:

TABLE NO8: Split tensile test on cylinder:

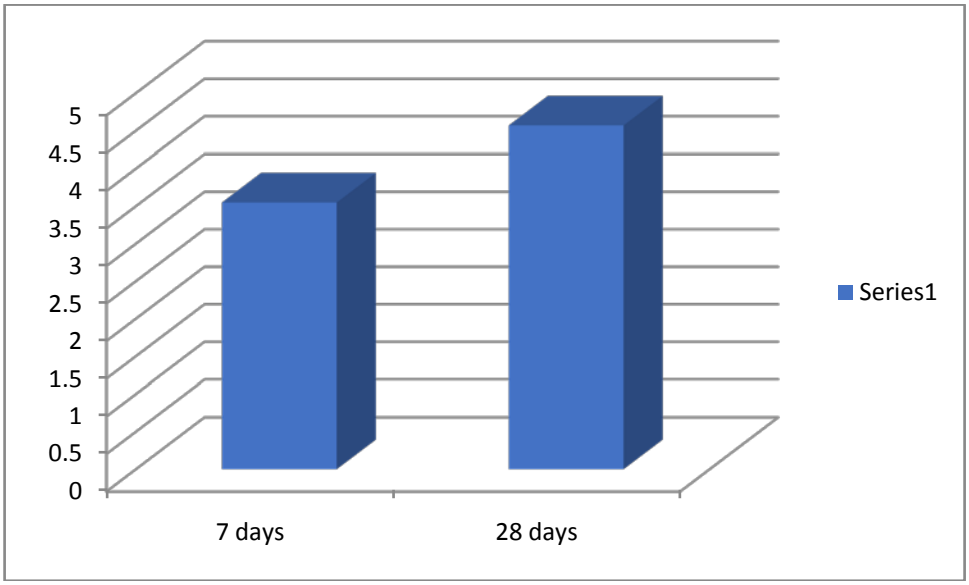
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	150	2.12
2		28 days	210	2.97



8.1.2.6 FLEXURAL STRENGTH ON 10% GROUNDNUT SHELL ADDED PRISM:

TABLE NO9: Flexural test on prism:

S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	38	3.37
2		28 days	47	4.18



8.1.2.7COMPRESSIVE TEST ON 15% GROUNDNUT SHELL ADDED CUBE:

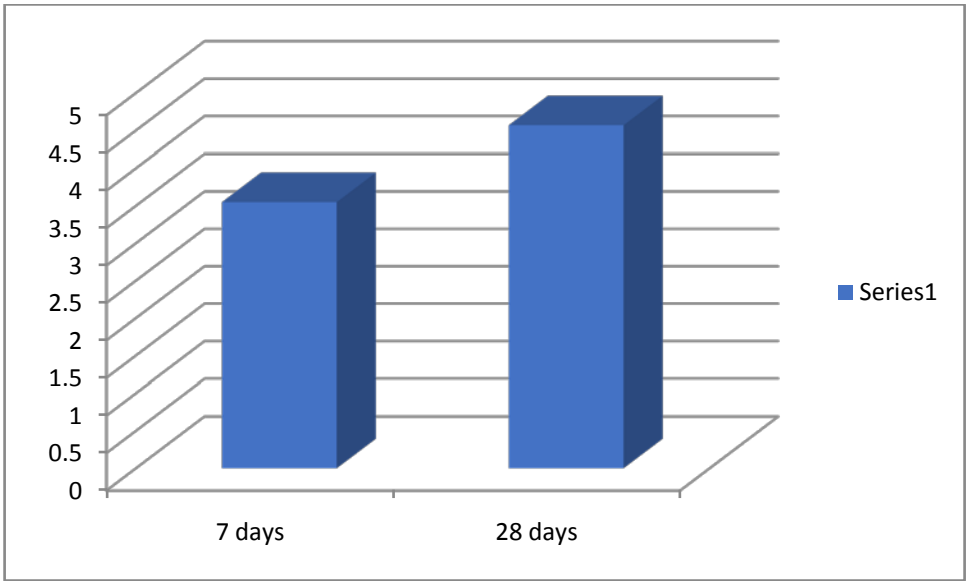
TABLE NO10: Compressive strength test on cube:

S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	310	13.77
2		28 days	820	36.44

8.1.2.8SPLIT TENSILE TEST ON 15% GROUNDNUT SHELL ADDED CYLINDER:

TABLE NO11: Split tensile test on cylinder:

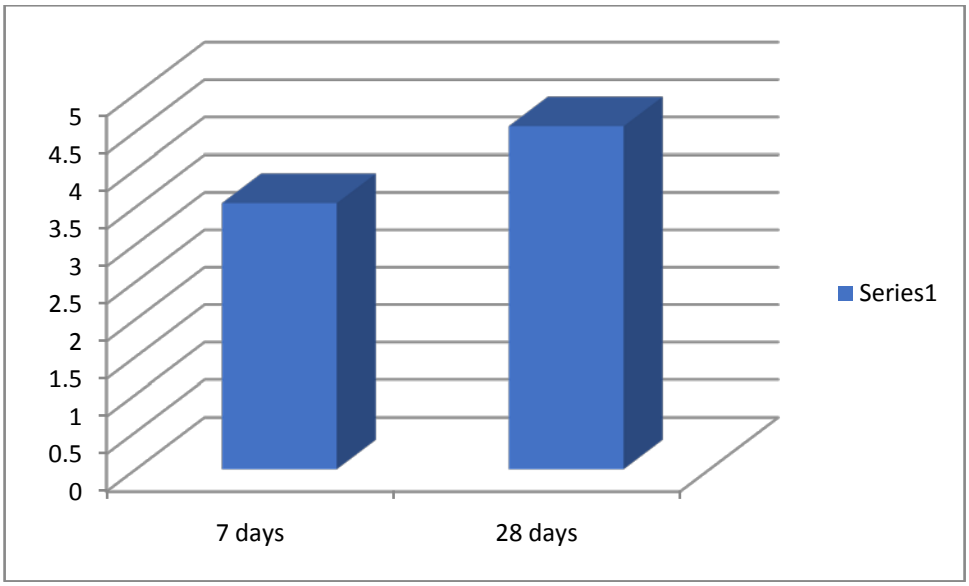
S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	164	2.3
2		28 days	240	3.39



8.1.2.9 FLEXURAL STRENGTH ON 15% GROUNDNUT SHELL ADDED PRISM:

TABLE NO12: Flexural test on prism:

S.no	Sample no	Curing period	Load at failure(KN)	Average compressive Strength (N/mm^2)
1	1	7 days	40	3.55
2		28 days	56	4.97



CONCLUSION

The use of groundnut shell ash in the concrete has shown maximum increase in strength. The use of groundnut shell ash has shown only a slight variation of increase when compared to conventional concrete. Thus the result is obtained positively by using economically available local materials. The ground nut shell ash strength increased up to 5%, 10%, 15%when compared to conventional concrete. Ultimately the use of these ground nut shell ash increase the strength of the construction.

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