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Partial replacement of cement by groudnut shell ash and sea shell powder

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1. Abstract: *The construction industry relies heavily on cement for its operations in the development of shelter and other infrastructural facilities. Various research workers in the recent past had look into the utilization of agricultural wastes that are known to be puzollanas to partially substitute cement that is the major component of concrete. The use of Ordinary Portland Cement (OPC) and Rice Husk Ash (RHA) concrete in minimizing thermally induced expansion cracks has been identified. The utilization of Groundnut shell will promote waste management at little cost, reduce pollution by these waste and increase the economic base of the farmer when such waste are sold thereby encourages more production. Also, GSA production required less energy demand compared with cement production and safe the needed foreign exchange spent on importation of cement or its constituents.The effective utilization of these sea shell wastes which are available almost free of cost and in abundance will not only reduce their pollution tendency but will help in reducing the amount of cement used in concrete work. Investigations are made in order to perform the partial replacement for cement in concrete by Groundnut Shell Ash and Sea shell powder.*

Keywords: Ordinary Portland Cement (OPC), Rice Husk Ash (RHA), SeaShell Powder(SSP)

2. Introduction

Cement concrete is the most widely used building material due to its satisfying performance in strength requirements and its ability to moulded into a variety of shapes and sizes. It is a construction material composed with cement and water combined with sand, crushed stone and other inert materials such as expanded slag or vermiculite. The major constituent of concrete is aggregate, which may be natural (gravel or crushed rock with sand) or artificial (blast furnace slag, broken brick and steel shot). Over the years, many waste materials like fly ash and ashes produced from various agricultural wastes such as palm oil waste, rice husk ash, millet husk ash have been tried as pozzalona or secondary cementious materials. The supplementary cementing materials play an important role when added to Portland cement because they usually alter the pore structure of concrete to reduce its permeability, thus increasing its resistance to water penetration and water related deterioration such as reinforcement corrosion, sulphate and acid attack. Since OPC is the typically most expensive constituent of concrete, the replacement of proportion of it with Groundnut Shell Ash(GSA) and Sea Shell Powder(SSP) may improve concrete affordability particularly for low cost housing. The use of GSA and SSP may contribute not only to the production of concrete of higher quality and lower cost but also lead to reduction of carbon dioxide(CO2) emission from the production of cement . Ground nut shell Ash is obtained from Groundnut shell, and is combusted to very high temperature.

3. Review of literature

Nwofor (2012) studied that a good tendency for pozzolonic action for percentage replacement less than 10% based on the previous research which is focused on looking for alternatives for OPC concrete, the GSA/OPC concrete is considered as a good development for masonry walls and mass foundations. And Groundnut shell is by product from agricultural waste cheaper than Ordinary Portland cement and available in large quantities, the utilization of this product in concrete work would reduce the effect of this agricultural waste an agent of environmental pollution Adole(2011) reported the effects of chemicals on the properties of the concrete with cement partially replaced with Groundnut Husk Ash. The principal characteristic measured was the compressive strength of Ordinary Portland cement(OPC) and OPC/GHA concrete after curing in three chemical solutions (MgSO4,NaCl,H2SO4).The result revealed that the OPC/GHA concrete performed the best in the chemical solutions. This concluded that OPC/GHA concrete having proven resistant to Magnesium sulphate and Sodium chloride. Hlong(2012) studied that lime can be produced from the Indian sea shells . He insisted that lime is manufactured from molluscan, oyster shells, periwinkle shells. Alabadan(2012) studied that there is a high possibility for partial replacement of cement with Bambara Groundnut shell ash in concrete. Partial replacement of Ordinary Portland cement about 10%.Bambara Groundnut shell ash in concrete is acceptable. Though the strength of OPC/BGSA concrete was lower that of 100% cement, it can be used for light load bearing elements. Benjamin .R Etuk(2001) studied that periwinkle shell ash, oyster shell ash and snail shell ash are pozzolonic in nature and it can be used as a cement replacement material. The water consistency increases with increase of the shell ashes.

4. Materials used

Cement

It 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. The cement used in this project is 43 grades Ordinary Portland Cement. The Ordinary Portland Cement of 43 grade conforming to IS: 12269-1987 has been used. The cement used has a specific gravity of 3.2, initial setting time of 30 minutes and final setting time of 335 min.

Groundnut Shell Ash

Groundnut shell ash is the residue powder that is left after the combustion of Groundnut shell. The groundnut shell is obtained as a agricultural waste, the nuts inside the shells used to get vegetable oil which is used in households .it has to be burn 500 to 600°C to get the ash. The groundnut shell ash used in this work was powdery, amorphous solid, from Kancheepuram. The ashes are sieved through 75microns sieve to obtain the size of the cement particles. The specify gravity test of GSA is found to be 2.25. This value is less than the value for cement which is 3.15 but however, it falls within the recommended range of 1.9 and 2.4 for pulverized fuel ash. It has a initial setting time of 95 minutes and final setting time of 610 minutes.

Sea Shell Powder

Since the Calcium Oxide content in the Groundnut Shell Ash (GSA) is comparatively very low than in cement, we have used Sea Shell Powder with Groundnut Shell Ash. The Sea shell powder is rich in Calcium oxide so increasing the sea shell powder content in GSA it will give extra strength. The shells were collected from the “Marina Beach “. Then these shells were over heated. Now the overheated sea shells are rapidly cooled by just sprinkling the water on it. After this cooling, these shells will be transformed into powder due to overheating and rapid cooling. The sea shells are heated to more than 800°C and rapidly cooled .the sea shell powder also sieved through the 75microns to obtain the cement size. The specific gravity of the sea shell powder is calculated as 2.50. The initial setting time is 76minutes and the final setting time is 360 minutes.

5. Slump:

The result for the slump test is shown in Table below. Test result shows that mixes with greater Groundnut shell ash content requires greater water content to achieve a reasonable workability

Table 1: Slump Values of Different Concrete

Type	Slump Value (mm)
Conventional	27
5% Replacement	33
10% Replacement	35
15% Replacement	39
20% Replacement	38

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Fig 1 Slump Cone Test

6. Results and Discussions

The compressive strength and flexural strength of concrete mix was determined for various mix proportions.

7. Compressive Strength Test

For cube test two types of specimens either cubes of 15 cm X 15 cm X 15 cm or 10cm X 10 cm x 10 cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15 cm x 15cm x 15 cm are commonly used.

Fig 2 Compressive Strength Test

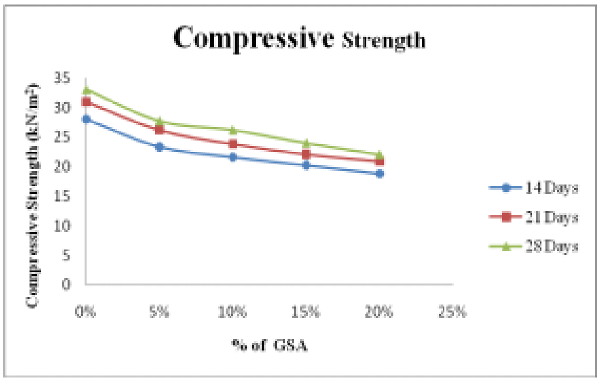

Fig 3 Compressive Strength for various % of GSA

The above fig 3 shows that as the curing period increases the compressive strength increases for higher percentages of GSA, as compared with the conventional specimen.

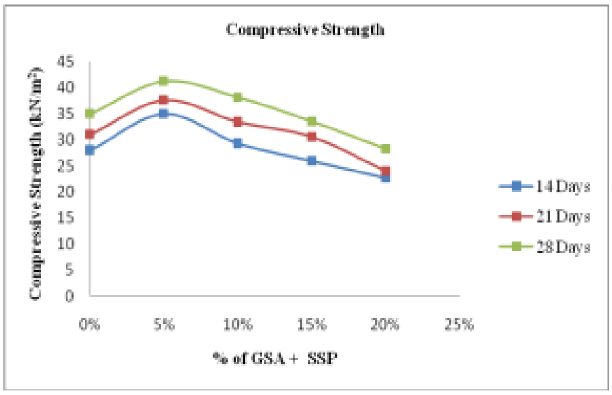

Fig 4 Compressive Strength for various % of GSA+SSP

The above fig 4 shows that as the curing period increases the compressive strength increases for 15 % of GSA +SSP, as compared with the conventional specimen.

8. Flexural Strength Test

The test for flexural strength of concrete beams under third point loading utilizes a beam testing machine which permits the load to be applied normal to the loaded surface of the beam. The specimen is tested on its side with respect to its moulded position. The beam is centred on the bearing supports. The dial indicator of the proving ring is placed at the zero reading. The load is applied at a uniform rate and in a way to avoid shock. The load required to cause specimen failure is obtained from the dial indicators final reading and the proving ring calibration curve.

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Fig 5 Flexural Strength Testing Machine

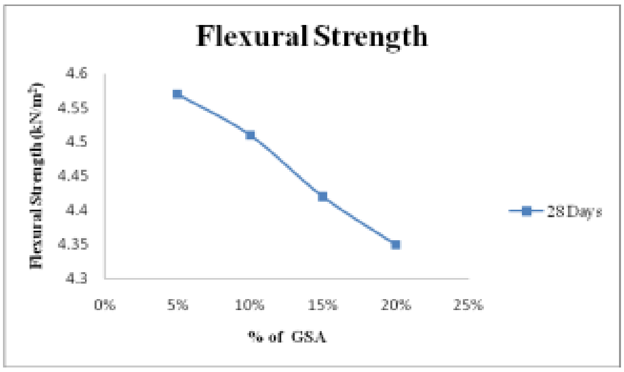

Fig 6 Flexural Strength for various % of GSA

Thus the above figure 6 compares the flexural strength value of Conventional concrete specimen to that of those replaced by 5%, 10% and 15%. It shows that specimen made with 5% replacement is better when compared with the other percentage of replacements and also found to be more or less equal to the conventional specimen.

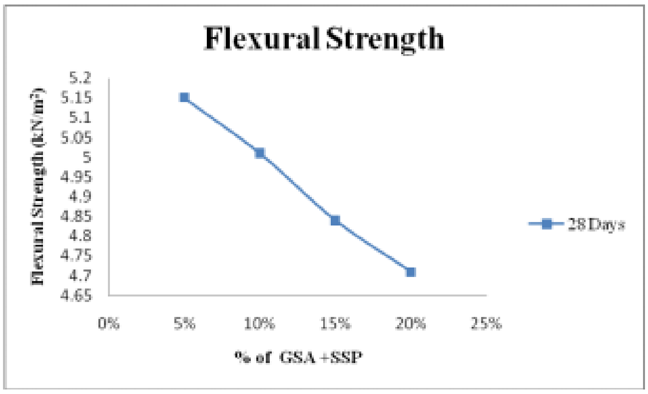

Fig 7 Flexural Strength for various % of GSA +SSP

Thus the above figure 7.compares the flexural strength value of Conventional concrete specimen to that of those replaced by 5%, 10% ,15% and 20%. It shows that specimen made with 5% to 10% replacement is better when compared with the other percentage of replacements and also found to be more than the conventional specimen.

9. Conclusions

From the results of the various tests performed, the following conclusions can be drawn.

(1)Groundnut shell and sea shell powder is a suitable material for use as a puzzolana, since it satisfied the requirement for such a material.

(2)Concrete becomes less workable as the Groundnut shell percentage increases meaning that more water is required to make the mixes more workable. This means that Groundnut Shell Ash concrete has higher water demand.

(3)But when sea shell powder is added to the Groundnut shell and partially replacing cement increases the compressive strength. It is due to the sea shell contains more amount of calcium content. The compressive strength generally increases with curing period and decreases with increased amount of Groundnut shell Ash. Only 10% GSA substitution is adequate to enjoy maximum benefit of strength gain.

(4)The compressive strength of also increases with the combination of sea shell powder up to 15% to 20% weight of cement.

(5)The effective utilization of these sea shell wastes which are available almost free of cost and in abundance will not only reduce their pollution tendency but will help in reducing the amount of cement used in concrete work.

10. References

(1) Stability of groundnut shell ash (GSA)/ordinary portland cement (OPC) concrete in Nigeria,T.C. Nwofor and S. Sule

(2) Alabadam, B.A.; Njoku, C.F. and Yusuf, M.O, Agricultural Engineering International: the CIGR Ejournal, 2006, Manuscript BC 05 012, vol.VIII.

(3) American Standard for Testing Materials, Specification for fly ash and raw or calcium natural pozzolana for use as a mineral admixture in Portland cement concrete. ASTMC 2005.

(4) Dashan, I.I. and Kamang, E.E.I., Nigeria Journal of Construction Technology and Management 1999, 2(1), 22-28.

(5) Nwofor, T.C and Eme, D.B., Journal of Chemical, Mechanical and Engineering Practice, vol 1.

(6) R. Badmus, Cement: Manufacturers fine-tune strategies to meet ultimatum, The Punch Newspaper (Nigeria), May 20, 2011, p. 32.

(7) M.S. Shetty, Concrete Technology, Theory and Practice, revised ed., S. Chand and Company Ltd., Ram Nagar, New Delhi, 2005, pp. 124-217.

(8) R.L. Michael, Civil Engineering Reference Manual, 6th ed., Professional Publications, Inc., Belmont, CA, USA, 1992, pp. 142-144.