International Journal of Engineering, Science and Mathematics
Vol. 6Issue 8, Month2017Dec,
ISSN: 2320-0294 Impact Factor: 6.765
Journal Homepage: http://www.ijesm.co.in, Email: ijesmj@gmail.com Double-
Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at:
Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A.

The Strength Modifier in Concrete by Cockle Shell Powder, E-Waste and Cockle Shells

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Abstract

The rising cost of building construction materials is the factor of great concern. We all want that our Building must be strong and should build with the construction materials of reasonable rates. The construction industries in India fully based on Cement, Sand and Aggregates for producing concrete goods. This project is experimented to reduce the cost of concrete and also reduce the Environmental pollution by using the waste materials. In this project an experimental study is made on the usage of cockle shell Powder as cement, E-waste as fine Aggregate and cockle shells as coarse Aggregate in concrete with a percentage replacement ranging from 0% to 15% (i.e. 0%,5%,10% and 15%) on the strength criteria of M25 Concrete. The coarse aggregate, fine aggregate, cement tests were conducted to evolute the engineering properties of the materials.In present study, compressive strength of concrete was evoluted. Results shows that partial replacement of these waste materials,able to produce workable concrete with satisfactory strength.The Strength obtained from Concrete with partial replacement of cockle shell powder, E- waste and cockle shells is compared with the conventional concrete, thus 5%,10% replacement of these materials were recommended for conventional concrete to increase the strength of concrete.

Keywords:

Cockle shell powder;
E-waste;
Cockle shells;
M_{20} grade concrete;
Compressive strength.

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1. Introduction

The construction material plays a major role in the life of constructions. In civil engineering construction materials, concrete holds main position. The production of concrete make complex with the ingredients of cement, aggregates, water and admixtures. The cockle shells have showns large oscilloscop for their act of

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using as a construction material. The greater usage of cockle shells will lead to not only saving such construction material but also helps in solute the problem of disposal of this waste product. The most economically, ecologically, light weight and improving the effect of work construction of the structure is extreme important in the present economy. Now a days we are using partial replacements in concrete by different waste products like fly ash, plastic waste, sludge, GGBS, wood waste, rice husk etc. In the present research, cockle shells has been used as partial replacement of coarse aggregate, cement by cockle shell powder and fine aggregate by E-waste. Cockle shells, E-waste are also available in large quantities.

2. Literature Review

2.1. Ali N. Alzaed [1] in this study, use of 10% iron fillings with concrete then the compressive strength was increased to 13% of conventional concrete.

2.2. P. Adewuyi and T. Adegoke et al [2] used various percentage replacements of periwinkle shells in concrete and determined the properties of the shells and stated that the strength of concrete is increased and; Concrete with 35.4% and 42.5% periwinkle shells 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.

2.3. Falade, Ikponmwosa and Ojediran (2010) [4] concluded the strength of lightweight concrete containing periwinkle shells at rised temperature and concluded that the compressive strength was decreased with increase in temperature ,water/cement ratio.

3. Research Method

3.1. Objectives

The work reported in this study. E-waste obtained from the companies of waste collection which is located at Singupuram road near at NH-5,srikakulam district is used as strength modifier in cement concrete. Cockle shells collected from kalingapatnam beach,srikakulam.

The ultimate focus of this work is to as certain the performance of cement concrete containing cockle shells,cockle shell powder and E-waste and compare it with the conventional concrete .this is expected to provide:

1. To partially replace concrete content with cockle shells,cockle shell powder and E-waste as it directly influences economy in construction.
2. To evaluate the cockle shells,cockle shell powder and E-waste comprssive strength at 7,14,28 days by replacing in concrete .
3. The test specimens should be allowed for further evolutions.
4. Environmental friendly disposal of cockle shells and E-waste. Hence this should controls the pollution of environment.
5. These should reduce the usage of natural products like aggregates.
6. To encourage the use of waste.

3.2 Methodology

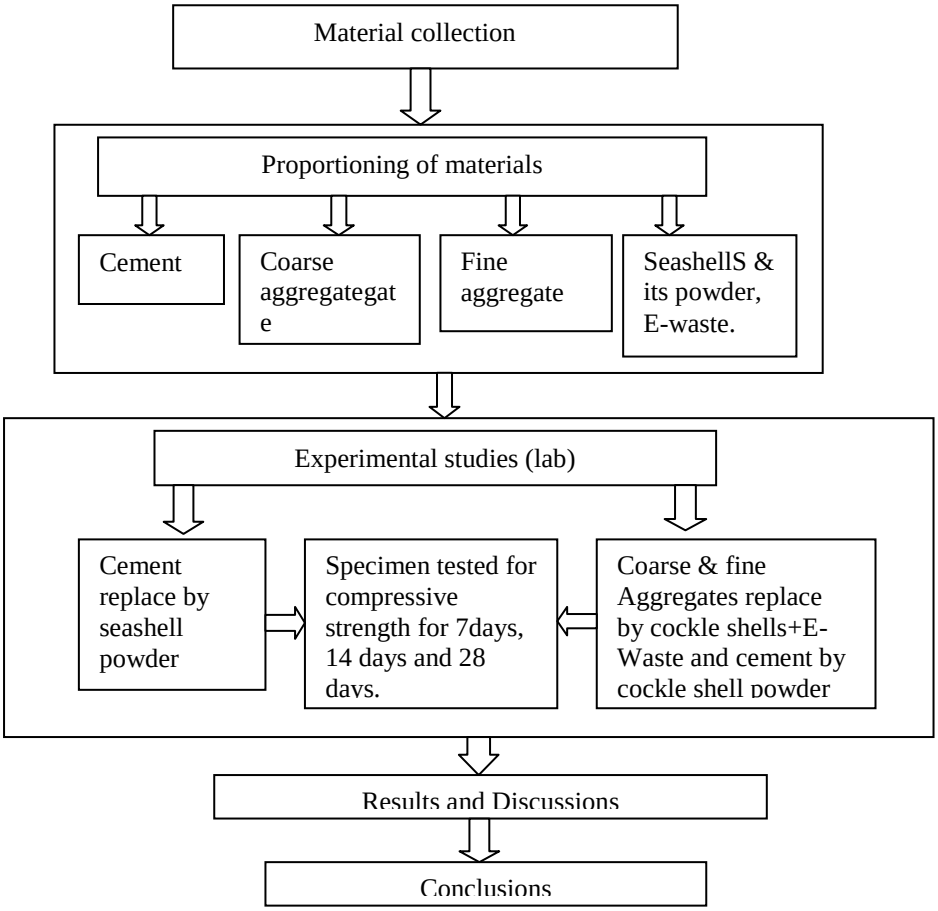


Figure 1: Flow chart of methodology

4. Materials used

Three basic materials are used for this study are cement replace by cockle shell powder, replacement of coarse aggregates by cockle shells & replacement of fine aggregates by E-waste.

4.1. Cement: Ordinary Portland cement (OPC) 53 grade is used.

4.2. Aggregates: Fine aggregates

Coarse aggregates

4.3. Cockle shell powder: The Sea shell powder is rich in Calcium oxide so increasing the sea shell powder content in GSA it will give extra strength. 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. It is powdered from seashells.

4.4. E-waste: Electronic waste conversationally known as E-waste from the waste electronic goods, nearing the end of their useful life. The E- waste products consists materials that are harmfull to the human beings, depending on their density, conditions. The damaged electronic materials like circuit boards, refrigirators, phones, discarded computers, mobiles & batteries etc, if not disposed properly, can lead to pollute substances of soil & underground water.

4.5. Cockle shells: A cockle is a small, comestible, marine bivalve. Many small comestible bivalves are loosely called cockles (bivalve shells), true bivalves are species in the family Cardiidae. Cockles live in sandy, sheltered beaches throughout the world. Bivalve shell is a hard, protective outer layer of animals which lives in the sea. After the life span of sea animals, the cockle shells are washed up on beaches by beachcombers. The bivalve shell has three layers (inhalant, exhalant, and pedal) for siphoning water and for

the foot to protrude. Because of calcium carbonate content, the cockle shells exhibits the strength requirements similar to aggregate.

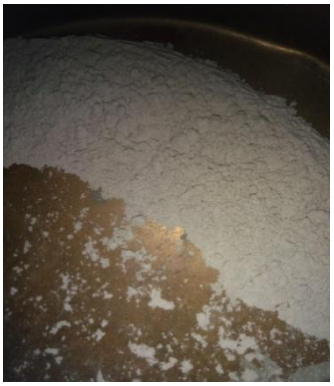


Figure 2: Cockle shell powder

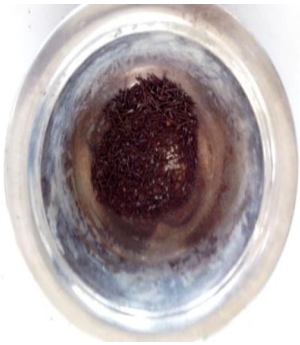


Figure 3: E-waste

Figure 4: Cockle shells

4.6. Tests conducted on materials:

4.6.1. Tests on aggregates:

Table 1 :(aggregates+seashells) properties in percentage

Percentage of seashells	Crushing value	Impact value	Abrasion values
0	22%	21%	23%
5	18%	19%	20%
10	20%	16%	18%
15	22.5%	22%	24%

4.6.2. Tests on cement:

Table 2: cement properties

S.NO.	PROPERTY	VALUES
01	**Specific gravity**	3.15
02	**Fineness of cement by sieving**	2.5%
03	**Normal consistency**	31%
04	**Setting time** **Initial setting time** **Final setting time**	 31 min 434 min
05	**Soundness**	6mm
06	**Compressive strength** 7days 14 days 28 days	 38N/mm2 47N/mm2 55N/mm2

5. Mix design for M-25 grade:

Design stipulations

i) Characteristic compressive strength required
In the field at 28 days : 25Mpa
ii) Maximum size of aggregates : 20mm
iii) Degree of workability : 0.90 compacting factor
iv) Degree of quality control : Good
v) Type of exposure : Mild

Test data for materials

i) Specific gravity of cement : 3.15
ii) Specific gravity of coarse aggregate : 2.6
iii) Specific gravity of fine aggregate : 2.7

Table 3: Quantity of materials required for cube preparation:

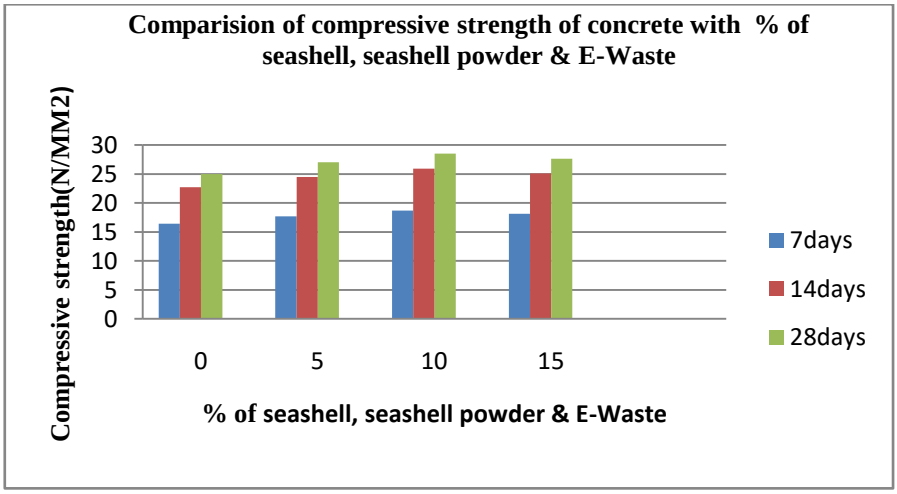
Material	Water	Cement	F.A	C.A
Kg/cum	191.58	491.2	568.9	1571.9
Ratio	0.68	1	1.2	3 2

6. Results and Analysis

Table 4: Compressive strength results for replacement of cement by Seashell powder

Replacement of concrete seashell, seashell powder & E-Waste by (Mix)	7 Days strength (N/mm^2)	14Days strength (N/mm^2)	28Days strength (N/mm^2)
0%	16.4	22.7	25
5%	17.7	24.5	27
10%	18.7	25.9	28.5
15%	18.1	25.1	27.6

6.1 Compressive strength of concrete



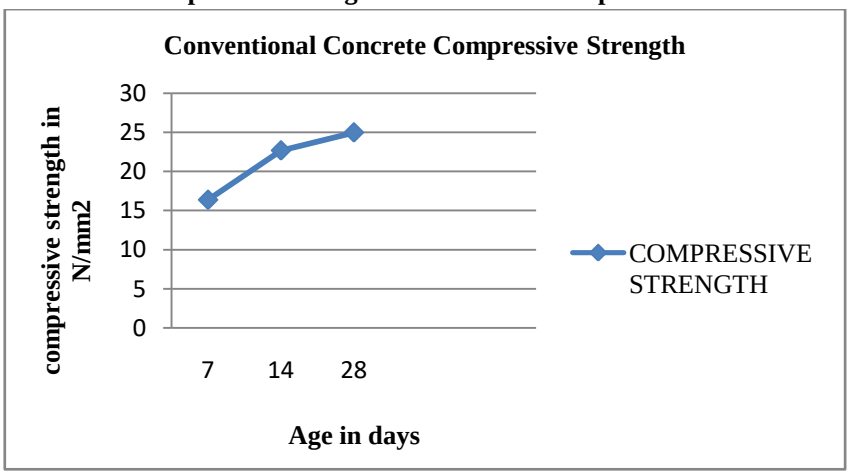
Graph 1: compressive strength of concrete

The above graph shows that, the 28 days compressive strength of concrete for 5% of partial replacement seashell, seashell powder & E-Waste is increased 8% when compared to conventional concrete compressive strength.

The above graph shows that, the 28 days compressive strength of concrete for 10% of partial replacement seashell, seashell powder & E-Waste is increased 5.6% when compared 5% of partial replacement of concrete compressive strength.

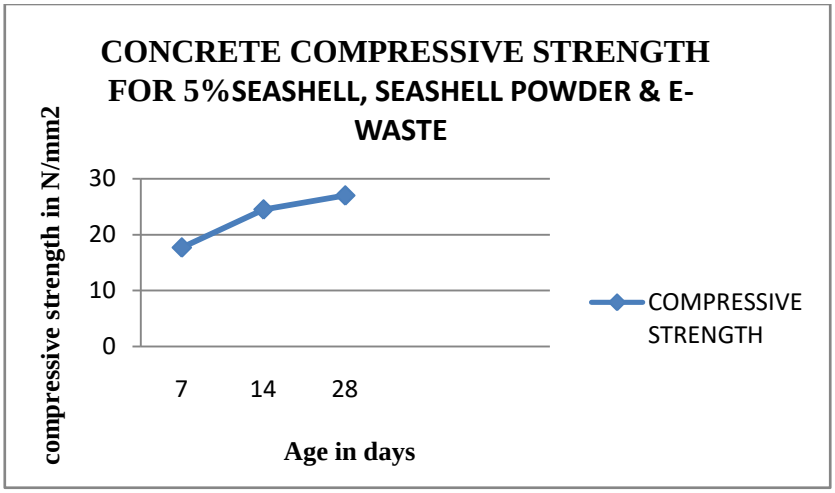
The above graph shows that, the 28 days compressive strength of concrete for 15% of partial replacement seashell, seashell powder & E-Waste is decreased 3.2% when compared to 10% of partial replacement of concrete compressive strength.

6.2 Conventional concrete compressive strength for 0% of seashell powder



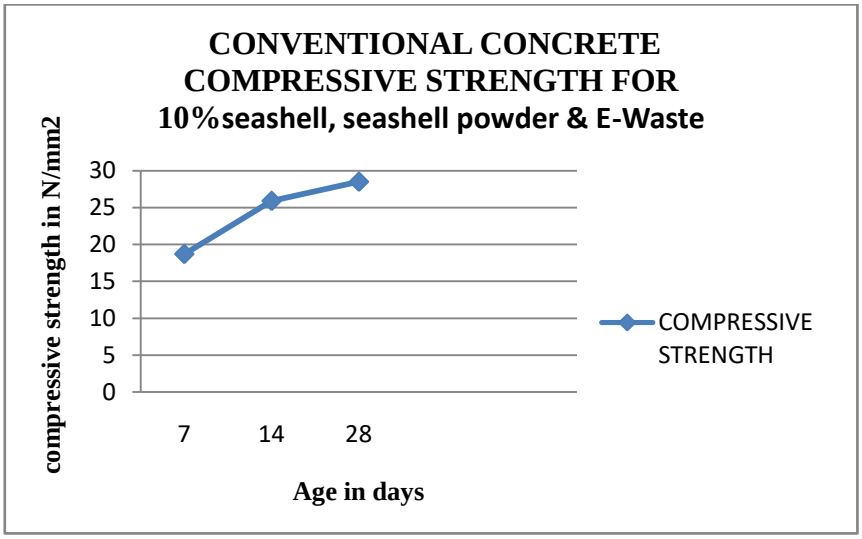
Graph 2: Conventional concrete compressive strength

6.3 concrete compressive strength for 5% of seashell, seashell powder & e-waste



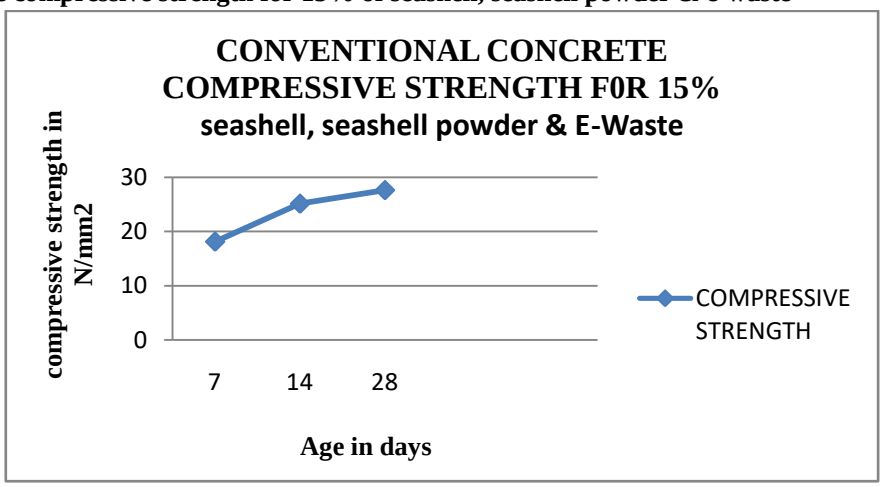
Graph 3: Concrete compressive strength for 5% of seashell, seashell powder & e-waste

6.4. Concrete compressive strength for 10% of seashell, seashell powder &E-waste



Graph 4: concrete compressive strength for 10% of seashell, seashell powder &E-waste

6.5. Concrete compressive strength for 15% of seashell, seashell powder & e-waste



Graph 5: Concrete compressive strength for 15% of seashell, seashell powder & e-waste

The bove graph shows that, the compressive strength of concrete for 5, 10% of partial replacement of seashell, seashell powder & E-Waste is increased to 8&14% when compared to conventional concrete. The compressive strength of concrete for 15% of partial replacement of seashell, seashell powder & E-Waste is decreased 3.2% when compared to 10%.

7. Conclusions

The conclusions derived from the present study listed below:

1. Compressive strength of concrete with partial replacement of cement by sea shell powder, fine aggregate by E- waste and coarse aggregate by cockle shell has gradually increased up to 5%, 10% and then decreased at 15%.
2. The compressive strength of concrete with 10% partial replacement of cement by sea shell powder, fine aggregate by E-waste and coarse aggregate by cockle shells has increased14% than the conventional concrete compressive strength.
3. The compressive strength of concrete with 15% partial replacement of cement by sea shell powder, fine aggregate by E-waste and coarse aggregate by cockle shells has increased10.4% than the conventional concrete compressive strength.
4. Compressive strength is increased with inclusion of cement replacement by seashell powder, fine aggregate by E-waste and coarse aggregate by cockle shells as compared with conventional concrete compressive strength.
5. For economical view, 15% is prefered and in the view of compressive strength 10% was proposed.

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