IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

BEHAVIOUR OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH SEASHELL POWDER AND FINE AGGREGATE BY WOODASH

[1]Dr. P. Paramaguru, [2]Mr. R. Uthirapathi,

[1]Associate Professor, [2]PG Scholar
[1]Department of Civil Engineering,
[1]Ponnaiyah Ramajayam Institute of Science and Technology, Thanjavur, India

Abstract: This project is about the exploratory study on the suitability of the Seashell powder and Wood ash as partial replacement in concrete. In developing countries where concrete is widely used, the high and steadily increasing cost of concrete has made construction very expensive. The high cost of conventional building materials is a major factor affecting housing delivery in world. This has necessitated research into alternative materials of construction. The main objective is to encourage the useof these products as construction materials in low-cost building. In this research work, experiments have been conducted with collected materials and the preliminary data obtained by various physical tests. The test samples suitable to the experiment are selected. The Chemical analysis for the Seashell powder and wood ash has been performed. In this project, Cement is replaced with 10% of Seashell powder and the fine aggregate is partial replaced with various levels such as 15 %, 20%, and 25 % by Wood ash. Further the concrete is produced with various proportions and tested and compared with conventional concrete.

INTRODUCTION

Concrete is one of the most used structural materials in construction. Every day the usage of concrete is increasing. In order to reduce reliance of raw material in concrete producing, the green concrete had been promoted. Green concrete is the concrete that had been produced using recycle or wasted natural materials. One of the ways to produce green concrete is by using modified cement and aggregates. Cement plays the role of a binder, a substance that sets and hardens and might bind alternative materials along. During production of cement and hydration process of cement, the amount of CO2 emitted by the industry is nearly 0.9 kg of CO2 for every 1 kg of cement produced. This CO2 production causes serious environmental damages. The Seashell powder have high ability to become partial Cement replacement and filler inconcrete. Moreover Seashell emits Carbon Dioxide only when it reacts with acids. The calcium oxide (CaO) in the sea shells is more than 85% .Impressively, the crystalstructures of seashells are largely composed of calcite and aragonite, which have higher strengths than limestone. Another replacement is Fine aggregates by Sawdust which is composed of 85% of SiO2 typically to that of Sand. The Concrete producedby this replacement with have good setting time, increased strength and a better workability when compared to controlled concrete.

CHEMISTRY OF SEASHELLS

A seashell is a hard, protective outer layer created by an animal without backbone that lives in the sea. It is composed of Calcium carbonate or Chitin with small quantity of Protein (RCH(NH2)COOH). Bicarbonates can be used as accelerators to enhance the early age properties of cementitious materials. Bicarbonates like $KHCO_3$ and $NaHCO_3$ could form strong alkali (KOH, NaOH) and cause potential risk of alkali-silica reaction.

$Ca(HCO_3)_2$ could serve as a better accelerator than these bicarbonates because offormation of $CaCO_3$ and $Ca(OH)_2$, which are usually found in cementitious system. $Ca(HCO_3)_2$ was found to accelerate the hydration of C_3S and C_2S at a later stage andmodify the pore structure of OPC paste.
The reaction between $Ca(HCO_3)_2$ and Portland Cement, which could fill the harmfulpores in Cement paste.

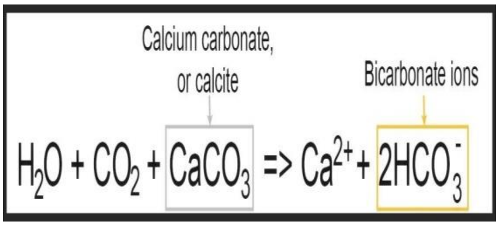


Figure 1.1 Calcite reaction with water

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 notonly saving such construction material but also assists in solving the problem of disposal of this waste product. 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 roleof the light weight concrete has come into the field.
Seashells are mainly made of an ionic bond known as 'CaCO3' or calcium carbonate. Hard, but reacts with acids to produce water, carbon dioxide and a salt.
As modern engineering practices become more demanding, there is a correspondingneed 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..Sea shells are also available in large quantities.

OBJECTIVE

- To study the behaviour of concrete by partial replacement with Seashellpowder and woodash.
- To increase compressive strength of concrete and setting time.
- To create sustainable environment and reduce problems of global warming.

LITERATURE REVIEW
In order to study the properties of the Wood dust and to improve the quality and workability of Concrete, some of the literatures are collected and shown below.
REVIEW OF LITERATURES
S.A.Raji and A.T.Samuel - "Egg Shell As A Fine Aggregate In Concrete For Sustainable Construction" (2015)
This paper about the potential use of used egg shell as a concrete material. The used egg shells were used as fine concrete aggregate. In the laboratory test, conventional fine aggregate was replaced at 100% replacement level. The cubes were cast, cured and tested. The strength development of the concrete mixes containing egg shell aggregates was compared to that of conventional concrete with sand as fine aggregate. The result showed a reduction in compressive strength of the concrete butstill falls within limits of lightweight concrete. This paper recommends that egg shellcan be used for producing concrete where a lighter weight concrete is required and a reduction of dead load of structure is desired.
ER. K JEGAN MOHAN AND B.MADHAN KUMAR - "A PARTIAL REPLACEMENT FOR COARSE AGGREGATE BY SEA SHELL AND CEMENT BY LIME IN CONCRETE" (2016)
This paper is about the exploratory study on the suitability of the cockle shellsas partial replacement for in concrete. This has necessitated research into alternative materials of construction and analysing tensile and compressive strength characteristics of concrete produced using by sea shells as substitutes for conventional coarse aggregate with partial replacement using M20 grade concrete. The main objective is to encourage the use of these products as construction materials.

MAISARAH ALI , MUHD SUFIAN ABDULLAH AND SITI ASMAHANI SAAD -). "EFFECT OF CALCIUM CARBONATE REPLACEMENT ON WORKABILITY AND MECHANICAL STRENGTH OF PORTLAND CEMENT CONCRETE" (2015)
The study deals with by replacing cement by calcium carbonate ($CaCO_3$). $CaCO_3$ is a natural material, which has a finer particles size as compared tothe cement particles. This improves particle packing of concrete and give spacer effect. The concrete with $CaCO_3$ replacement possess a higher slump, which increased the workability. The specimens were prepared in thr mould. At 28 days, thewater absorbed by hardened concrete was lower for $CaCO_3$ as microscopy analysis indicates very low porosity in $CaCO_3$ concrete. Mechanical properties tests were conducted in various intervals. The $CaCO_3$ helps to increase the early strength, due to the accelerator effect and high rate of hydration which hardens the

concrete quicker. At matured age, the concrete with the $CaCO_3$ addition exhibits lower strength as compared with concrete without $CaCO_3$, but still within the target strength.

UCHECHI G. EZIEFULA , JOHN C. EZEH AND BENNETT I. EZIEFULA - "PROPERTIES OF SEASHELL AGGREGATE CONCRETE" (2018)

Construction and Building Materials directed towards sourcing alternative sustainable materials for concrete in order to minimise over-reliance on natural resources. Many of the substitute materials used for producing green concrete are recycled materials obtained from industrial wastes and by-products. A promisingsolution to the challenge of seashell waste management involves utilising seashells as construction materials in concrete. Experimental investigations have been carried out on the use of mollusc seashells such as periwinkle shell, mussel shell, oyster shell,cockle shell, crepidula shell, clam shell and scallop shell as aggregate replacement materials in concrete. The seashells were utilised as partial or total replacement of fine and coarse aggregates in concrete. Mollusc seashells have similar chemical composition with limestone-type aggregates but characteristically contain traces of chloride and sulphate salts. Although inclusion of seashell aggregate reduces the mechanical properties of concrete, utilising some seashells as partial coarse aggregateat up to half substitution level can produce normal-weight concrete for non-structuraland low-strength structural functions.

MONITAOLIVIA , ANNISAARIFANDITA MIFSHELLA AND LITADARMAYANTI – "PROPERTIES OF CONCRETE CONTAINING GROUND WASTE COCKLE AND CLAM SEASHELLS" (2016)

This project relates by replacing aggregate by Blood clam or cockle shell is a type of marine by-product partially in concrete. In this research, the ground cockleseashell was used as a partial cement replacement. The ground seashells were prepared by burning, crushing, grinding and filtering the cockle .The mechanical properties studied were compressive strength, splitting tensile strength, flexuralstrength and modulus of elasticity of seashell concrete. These properties were compared with those of a control Ordinary Portland Cement (OPC) concrete. Various trial mixes was performed with different proportions using the ground seashell by weight of cement, the optimum compressive strength was achieved. The seashell concrete yielded less compressive strength and modulus elasticity compared to the OPC concrete. It is noted that the tensile strength and flexural strength were higher than those of the OPC concrete, which is advantageous to increase concrete tension properties.

VENKATA SAIRAM KUMAR N , DR. B. PANDURANGA RAO AND KRISHNA SAI M.L.N – "EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT WITH QUARRY DUST"(2013)

This paper deals with partially replacing fine aggregate by quarry dust in concrete for studying the strength property of concrete. The aim of the experiment is to find the maximum content of quarry dust partial replacement of cement in concrete. The percentages of quarry dust partial replacement of cement in concrete are M20, M30, M40 grade concrete cubes of standard size were cast for conducting compressive strength test. From the experimental studies the partial replacement of cement with quarry dust improved hardened concrete properties.

VELMURUGAN AND JOSE RAVINDRA RAJ - "EFFECT ON STRENGTH PROPERTIES OF M30 GRADE OF CONCRETE BY USING WASTE WOOD POWDER AS PARTIAL REPLACEMENT OF SAND" (2017)

The study deals on partial replacement of waste wood powder by varying proportion in the concrete .The replacement of fine aggregate (sand) with certain wooden powder in Concrete that makes the structure more light in weight. Compressive strength and split tensile strength was found to be good when comparedto conventional concrete, percentage increase of wood ash showed increase instrength. Addition of wood ash makes the concrete light weight. Wood waste powder replacement with sand for 10%, 20%, 30% was found to be higher than conventional concrete. Using of wood waste powder as replacement of sand is cost effective and user friendly. Optimum level of replacement was found for wood ash with sand. Thusit is clearly known that wood ash can be partially replaced for sand and it can be considered as an alternative fine aggregate.

NEETESH KUMAR AND ASHISH GUPTA – " LOW COST CONSTRUCTION MATERIAL FORCONCRETE AS SAWDUST" (2014)

The work carried out to investigate the effects of introducing the costbetween sand used concrete block and sawdust used concrete block. For making the concrete blocks we are using coarse aggregate, fine aggregate, cement, water and sawdust to mix it. Using some percentage of sawdust in place of sand while other things are same. Then to see the difference in weight between the originally concrete.

SUMMARY OF REVIEW OF LITERATURE

- On review of all literature the reaction between concrete and variousalternatives has been studied.
- The physical and chemical properties of saw dust have been viewed.
- By adopting a partial replacement with the construction materials, the outcomeconcrete has become cost effective and improved the properties.

METHODOLOGY

MATERIALS

Concrete is one of the most versatile building materials. It can be case to fit any structural shape it is readily available in urban areas at relatively low cost concrete is strong under compression and weak under tension and a relatively brittle material of the reinforced is needed. The most common types of concrete reinforce isby steel bars .the advantage of using concrete include high compressive strength, good, fire resistance, high water resistance, low maintenance and long service life. It also has a few disadvantage like poor tensile strength and formwork requirement.

CEMENT

The Ordinary Portland Cement was used in this work.

FINE AGGREGATE

Manufactured sand (M-Sand) is a substitute of river sand for concrete construction. Manufactured sand is produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand (M-Sand) is less than 4.75mm.

It does not contain organic and soluble compound that affects the setting time and properties of cement, thus the required strength of concrete can be maintained.

It does not have the presence of impurities such as clay, dust and silt coatings, increase water requirement as in the case of river sand which impair bond between cement paste and aggregate. Thus increased quality and durability of concrete.

COARSE AGGREGATE

Coarse aggregates predominately retained on a No. 4 (4.75-mm) sieve are classified as coarse aggregate. Generally, the size of coarse aggregate ranges from 5 to 150 mm.For this research purpose 20mm coarse aggregates are used.

SEASHELL POWDER

Seashell Powder is derived from natural sea shell. It is a rich source of calcium. Sea shell is a waste obtained near the seashore area as the result of disintegration of deadanimals. 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 nacrewhich is made up of calcium carbonate. Since 95% of calcium carbonate present in sea shell, it has the strength nearly equal to coarse aggregate.

Figure 3.2 Seashell Powder

ADVANTAGES OF USING SEASHELL CONCRETE

- The Chemical bonds are stronger hence it improves the strength of concrete.
- It fastens the setting time without the use of external admixtures.
- It fills the harmful pores in the Concrete.
- The bicarbonates modify the structure of OPC.
- Fastens the C2S and C3S hydration

WOOD ASH

Wood ash is a by-product or waste product of woodworking operations such as sawing, milling, planning, routing, drilling and sanding. It is composed of fine particles of wood. These operations can be performed by wood working machines, portable power tools or by use of hand tools.

Sawdust is the main composed of Silicon Dioxide which is about is more than 80% which is almost similar to the sand. Wood dust is a form of particulate matter or particulates. Saw dust is also known as wooden dust. It is the result of cutting, drilling wood. It is composed of fine particles of wood, certain animals, birds and insects which live in wood such as carpenter ant are also responsible for producing the wooden dust. It is produced as a small irregular chips or small garbage of wood duringsawing of logs of timber into different sizes. Sawdust is the main component of particleboard. It has a variety of other practical uses including serving as mulch,an alternative to clay cat litter, or as a fuel. It can present as a hazardous material in manufacturing industry, in terms of its flammability.

The use of sawdust for making lightweight concrete has received some attention over the past years. Researchers say that as a substitution material for natural sand, sawdust ash might be the right choice as fine aggregate in concrete. It can considerably reduce the dumping problem and simultaneously helps the preservation of natural fine aggregate.

Many researchers tested the behaviour of sawdust ash in concrete and reported that sawdust possessed unique characteristics, which make it competitive among other construction materials. Wood dust becomes a potential health problem when, for example, the wood particles, from processes such as sanding, become airborne and are inhaled. Wood dust is a known human carcinogen. Therefore by using it as a replacement for fine aggregate, the dust content present in the surrounding can be minimized and further save the natural resources from being depleted.

Figure 3.3 Woodash

PHYSICAL AND CHEMICAL TEST OF SAMPLES3.3.1TEST ON ORDINARY PORTLAND CEMENT

Standard Consistency Test

A Minimum quantity of water required to initiate the chemical reaction between water and cement to form a paste is known as consistency of cement.

Standard Consistency is that cement consistency which will allow the Vicat plunger to penetrate to 5-7 mm point from the bottom of Vicat mould is known as standard consistency.

- Test Procedure
- Take 400 grams of Cement.
- Assuming that consistency would be 29% since we are taking OPC. This istrial and error method.
- Take 29.5% of water that means (400×29%) = 118 Grams of water.
- Mix the water with cement and wait for 3-5 Minutes Mix the cement well.
- Now fill the Vicat mould with the cement paste.
- Ensure to compact the paste well after filling the mould.
- Fill the cement paste to the top of the mould. Remove the excess paste by thetrowel.
- Now place the mould at the Vicat apparatus.
- Now remove the plunger and allow it to penetrate through the paste.
- After removing wait for 3 seconds.
- Note down the reading on the Vicat measuring scale.

Figure 3.4 Vicat Appartus

INITIAL AND FINAL SETTING TIME OF CEMENT

It is the time lapse between the addition of water and the instant cement paste startsto lose its plasticity.

PROCEDURE:-

- Take 400g of cement and place it in a bowl or tray.
- Now add water of Start the stopwatch at the moment water is added to the cement.Water of quantity 0.85P.times (Where P is the Standard consistency of cement) is considered.
- Now fill the mix in Vicat mould. If any excessive paste remained on Vicat mouldis taken off by using a trowel.
- Then, place the vicat mould on nonporous plate (Glass plate) and see that the plunger should touch the surface of VICAT mould gently.
- Release the Plunger and allow it to sink into the test mould.
- Note down the penetration of the plunger from the bottom of mould indicated on the scale.
- Repeat the same experiment at different positions on the mould until the plunger should stop penetrating 5 from the bottom of the mould.
- The time period elapsed between the moment water is added to the cement and the time, the needle fails to penetrate the mould of 5mm when measured from the bottomof the mould**,** is the initial setting time of cement.
- Now replace the needle (plunger) by the one with an annular attachment. The cement is assumed as finally set when upon

applying the needle gently to the surfaceof the test mould, the needle makes an impression therein, while the attachment failsto do so.

- The time period between the moment water is added to the cement and the time at which needle makes an impression on the surface of the mould, while the attachment fails to do so**,** is the final setting time of cement.

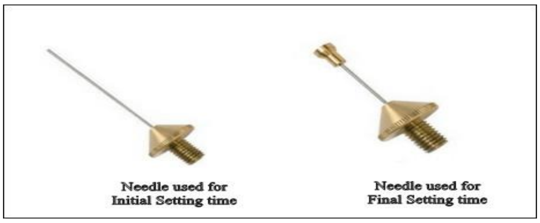


Figure 3.5 Setting time Needle

SPECIFIC GRAVITY TEST ON CEMENT

Specific Gravity is the ratio of the density of a substance to the density of a referencesubstance at a fixed temperature. Maximum time water is used as a referencesubstance. And its temperature should be near at 4°C. For gases, it is air at room temperature 25°C. But if "Cement" is used as a sample substance then Kerosene would be the reference substance. Because cement hydrates and forms calcium oxidewhen it reacts with water. But kerosene won't show any reaction when it mixed withCement.

REQUIRED MATERIALS & APPARATUS

- Kerosene
- Ordinary Portland Cement
- Pycnometer of 100 ml
- Weighing balance with 0.1 gm accurate

Test procedure

- Take about 500g of sample and place it in the pycnometer.
- Pour distilled water into it until it is full.
- Eliminate the entrapped air by rotating the pycnometer on its side, the hole in theapex of the cone being covered with a finger.
- Wipe out the outer surface of pycnometer and weigh it (W)
- Transfer the contents of the pycnometer into a tray, care being taken to ensurethat all the aggregate is transferred.
- Refill the pycnometer with distilled water to the same level.
- Find out the weight (W1)
- Drain water from the sample through a filter paper.
- Place the sample in oven in a tray at a temperature of 100ºC to 110º C for 24±0.5hours, during which period it is stirred occasionally to facilitate drying.
- Cool the sample and weigh it (W2)

Formula

$$G = \frac{m_2 - w_1}{(m_2 - m_1) - (m_4 - m_3)}$$

FINENESS MODULUS TEST BY SIEVE ANALYSIS METHOD

Sieve analysis helps to determine the particle size distribution of the coarse and fine aggregates.

This is done by sieving the aggregates as per IS: 2386 (Part I) – 1963. In this we usedifferent sieves as standardized by the IS code and then pass aggregates through themand thus collect different sized particles left over different sieves.

PROCEDURE

- The test sample is dried to a constant weight at a temperature of 110 + 5ºC andweighed.
- The sample is sieved by using a set of IS Sieves.
- On completion of sieving, the material on each sieve is weighed.
- Cumulative weight passing through each sieve is calculated as a percentage of thetotal sample weight.
- Fineness modulus is obtained by adding cumulative percentage of aggregatesretained on each sieve.

LOOSE BULK DENSITY TESTPROCEDURE

- Measure the volume of the cylindrical metal measure by pouring water into themetal measure and record the volume "V" in litre.
- Fill the cylindrical measure to overflowing by means of a shovel or scoop, the aggregate being discharged from a height not exceeding 5 cm above the top of the measure
- Level the top surface of the aggregate in the metal measure, with a straightedge ortamping bar.
- Determine the weight of the aggregate in the measure and record the weight "W" in kg.

CALCULATION

Loose unit weight or bulk density = W/VWhere,

W = Weight of loose aggregate in cylindrical metal measure (kg)

V = Volume of cylindrical metal measure (m^3)

COMPACTED BULK DENSITY OF FINE AGGREGATEPROCEDURE

Measure the volume of the cylindrical metal measure by pouring water into the metalmeasure and record the volume "V" in litre.

- Fill the cylindrical metal measure about one-third full with thoroughly mixed aggregate and tamp it 25 times using tamping bar.
- Add another layer of one-third volume of aggregate in the metal measure and giveanother 25 strokes of tamping bar.
- Finally fill aggregate in the metal measure to over-flowing and tamp it 25 times.
- Remove the surplus aggregate using the tamping rod as a straightedge.
- Determine the weight of the aggregate in the measure and record that weight "W"in kg.

Calculation for Compacted Bulk Density Compacted unit weight or bulk density = W/VWhere,

W = Weight of compacted aggregate in cylindrical metal measure, kgV = Volume of cylindrical metal measure (m^3)

TEST ON COARSE AGGREGATES

Specific gravity and water absorption test

Specific gravity test of aggregates is done to measure the strength or quality of the material while water absorption test determines the water holding capacity of the coarse and fine aggregates.

PROCEDURE

- About 2 kg of aggregate sample is washed thoroughly to remove fines, drained andplaced in wire basket and immersed in distilled water at a temperature between 22- 32º C and a cover of at least 5cm of water above the top of basket.
- Immediately after immersion the entrapped air is removed from the sample by lifting the basket containing it 25 mm above the base of the tank and allowing it to drop at the rate of about one drop per second. The basket and aggregate should remain completely immersed in water for a period of 24 hour afterwards.
- The basket and the sample are weighed while suspended in water at a temperature of 22° – 32°C. The weight while suspended in water is noted = W_1g.
- The basket and aggregates are removed from water and allowed to drain for a fewminutes, after which the aggregates are transferred to the dry absorbent clothes. The empty basket is then returned to the tank of water jolted 25 times and weighed in water= W_2 g.
- The aggregates placed on the absorbent clothes are surface dried till no further moisture could be removed by this cloth. Then the aggregates are transferred to the second dry cloth spread in single layer and allowed to dry for at least 10 minutes untilthe aggregates are completely surface dry. The surface dried aggregate is thenweighed = W_3 g

FORMULAS

Specific gravity = $W_3 / (W_3 – (W_1 – W_2))$ Water Absorption = $((W_3 – W_4) / W_4)$ X 100**Fineness modulus test**

Fineness modulus of coarse aggregates represents the average size of the particles inthe coarse aggregate by an index number. It is calculated by performing sieve analysis with standard sieves.

To find fineness modulus of coarse aggregate we need sieve sizes of 37.5mm, 25mm,20mm, 13.2mm, 10mm, 6.3mm, 4.75 and Pan.

CASTING OF CONVENTIONAL CONCRETE

Conventional concrete is a conglomerate of hydraulic (Portland) cement, sand, stone,and water. It was developed by providing less labor intensive methods of shaping thematerial casting rather than hewing and carving). As such, it was initially expected toresist only compressive loads.

CASTING OF MODIFIED CONCRETE

Concrete cubes of size 150mm*150mm*150mm is to be casted with different proportions of woodash powder keeping the replacement level of Seashell powder constant.

CURING OF SAMPLES

Curing of Concrete is a method by which the concrete is protected against loss of moisture required for hydration and kept within the recommended temperature range. Curing will increase the strength and decrease the permeability of hardened concrete. The concrete specimens to be cured for 7,14 and 28 days.

TESTING OF CONCRETE SPECIMENS

The compressive strength, tensile strength, modulus of elasticity and permeability tests are performed for both standard concrete and modified concrete and compared.

MATERIALS TESTING

Test on Ordinary Portland cement

STANDARD CONSISTENCY TESTOBSERVATION

Table 4.1 Standard consistency of cement

TRAIL	WEIGHTOF CEMENT(GRAMS)	PERCENTAGE OF WATER	AMOUNT OF WATER(ML)	POINTER READING
1	400	26	104	38
2	400	27	108	36
3	400	28	112	32
4	400	29	116	30

Test is done as per IS: 4031 (Part 4) 1988 and from the results the Standardconsistency of cement was found to be 29%.

INITIAL AND FINAL SETTING TIME OF CEMENT

As Per IS: 4031 (Part 5) – 1988 Initial and final setting time of cement is calculatedusing VICAT apparatus conforming to IS: 5513 – 1976,

OBSERVATION

The Initial setting of Ordinary Portland cement is 33 Minutes and the Final settingtime is 9 Hours 50 Minutes.

The Initial and Final setting time of concrete with 10% replaced with seashell powderis 28 Minutes and the Final setting time is 9 Hours 50 Minutes.

SPECIFIC GRAVITY TEST ON CEMENT

The specific gravity was determined using Le chatelier flask as per IS 2720:Part -3and value was found to be 3.14.

TEST ON FINE AGGREGATES

Specific Gravity test

OBSERVATION

Table 4.2 Pycnometer test

SI No	Description	Weight
1	Weight of Pycnometer(W1)	605g
2	Weight of Pycnometer+Sand (w2)	1080g
3	Weight of Pycnometer+Sand+Water(w3)	1460g
4	Weight of Pycnometer+Water(w4)	1760g

As per IS:2386 Part 3-1963 the Specific gravity of fine aggregate is 2.72 and arewithin the permissible limits.

FINENESS TESTOBSERVATION

Table 4.3 Sieve analysis of fine aggregate

SI no	Sieve size	Weight retained (grams)	Percentage weight retained	Cumulative weight retained
1	4.75mm	0	0	0
2	2.36mm	0	0	0
3	1.18mm	95	9.5	9.5
4	600 µm	215	21.5	31
5	300 µm	420	42	73
6	150 µm	215	21.5	94.5
7	75 µm	45	4.5	99
8	Pan	10	1.0	100

From the values from sieve analysis the fineness modulus is found to be 3.07 for Fine aggregate (M sand). It is within the permissible limits as per IS: 2386 (Part I) – 1963

LOOSE AND COMPACTED BULK DENSITY

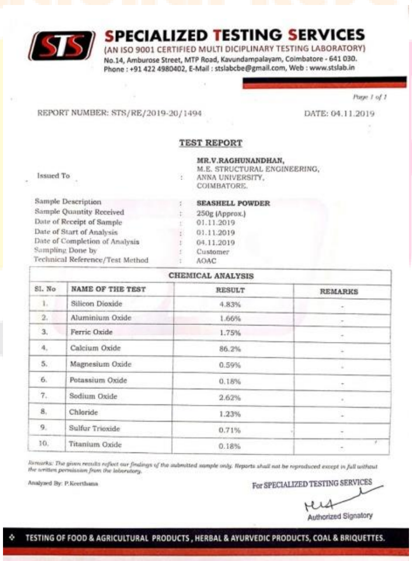
The Loose Bulk density of fine Aggregate is 1811 kg/m^3Compacted bulk Density was found to be 1658 kg/m^3.

TEST ON COARSE AGGREGATES

Specific gravity test and water absorption test

Test was conducted as per IS:2386-Part 3-1963 and was found that the specificgravity and Water Absorption was found to be 2.78 and 0.30% respectively.

FINENESS MODULUS TESTOBSERVATION


SPECIALIZED TESTING SERVICES
(AN ISO 9001 CERTIFIED MULTI DICIPLINARY TESTING LABORATORY)
No.14, Amburose Street, MTP Road, Kavundampalayam, Coimbatore - 641 030.
Phone : +91 422 4980402, E-Mail : stslabcbe@gmail.com, Web : www.stslab.in

Page 1 of 1

REPORT NUMBER: STS/RE/2019-20/1494 DATE: 04.11.2019

TEST REPORT

Issued To : MR.V.RAGHUNANDHAN, M.E. STRUCTURAL ENGINEERING, ANNA UNIVERSITY, COIMBATORE.

Sample Description : SEASHELL POWDER
Sample Quantity Received : 250g (Approx.)
Date of Receipt of Sample : 01.11.2019
Date of Start of Analysis : 01.11.2019
Date of Completion of Analysis : 04.11.2019
Sampling Done by : Customer
Technical Reference/Test Method : AOAC

CHEMICAL ANALYSIS

SI. No	NAME OF THE TEST	RESULT	REMARKS
1.	Silicon Dioxide	4.83%	-
2.	Aluminium Oxide	1.66%	-
3.	Ferric Oxide	1.75%	-
4.	Calcium Oxide	86.2%	-
5.	Magnesium Oxide	0.59%	-
6.	Potassium Oxide	0.18%	-
7.	Sodium Oxide	2.62%	-
8.	Chloride	1.23%	-
9.	Sulfur Trioxide	0.71%	-
10.	Titanium Oxide	0.18%	-

Remarks: The given results reflect our findings of the submitted sample only. Reports shall not be reproduced except in full without the written permission from the laboratory.

Analyzed By: P.Keerthana

For SPECIALIZED TESTING SERVICES

Authorized Signatory

TESTING OF FOOD & AGRICULTURAL PRODUCTS, HERBAL & AYURVEDIC PRODUCTS, COAL & BRIQUETTES.

Table 4.4 Sieve analysis of coarse aggregate

SI NO	IS SIEVE NO	WEIGHT RETAINED(KG)	PERCENTAGE OF WEIGHT RETAINED	CUMULATIVE PERCENTAGE WEIGHT RETAINED
1	37.5mm	0	0	0
2	25mm	0.05	1	1
3	20mm	2.20	44	45
4	13.2mm	2.625	52.5	97.5
5	10mm	0.050	1	98.5
6	6.3mm	0.30	0.6	99.1
7	4.75mm	0	0	99.1
8	Pan	0.045	0.9	100

The Fineness Modulus of 20 mm Coarse aggregate was found to be 4.402.

TEST ON WOODASH

Specific gravity and density test

Using Le Chatelier Flask the specific gravity was found to be 1.65.Density of Wood dust is 210kg/m^3.

CHEMICAL COMPOSITION TEST

Table 4.5 Chemical analysis of woodash

SI NO	Constituents	Percentage by Weight
1	Silicon Dioxide	87
2	Aluminium Oxide	2.5
3	Ferric Oxide	2.0
4	Magnesium Oxide	0.24
5	Calcium Oxide	3.50
6	Loss on Ignition	4.76

Test on Seashell powder

Specific gravity test

The Specific Gravity of Seashell powder found as 2.09.

Chemical analysis test

From the test result it is clear than seashell powder has cementitous constituents andrich is calcium content so there are suitable for the experiment.

TESTING OF CONCRETE AND RESULTS

COMPRESSIVE STRENGTH TEST

The cube compressive strength results at the various ages such as 7 days and 28 days for conventional M25 and different replacement percentage for cement 5%, 10%, 15% with the Seashell powder. Cubes were cast as per IS 516:1959. Size of cube used 150mmx150mmx150mm. Results are shown in table 4.7 and 4.8 respectively.

Table 5.1 Compressive strength results of conventional M25 concrete

	Average compressive strength at 7 days (N/mm2)	Average compressive strength at 28 days (N/mm2)
Conventional M25Concrete	16.22	25.13

Table 5.2 Compressive strength of Seashell powder Concrete

% of Seashell Powder replaced with Cement	Average compressivestrength at 7 days (N/mm2)	Average compressive strength at 28 days (N/mm2)
5	17.23	29.12
10	18.54	32.08
15	18.01	30.87

From the test results, it is clear that 10% replacement of seashell powder with cement shows the greater strength compared it other replacements and conventional M25 concrete.

Figure 5.1 Crack pattern of 10% replaced of Seashell powder Concrete

Figure 5.2 Compression value of 10% replaced Seashell powder Concrete

Compression test results for Seashell powder concrete with keeping the replacementof cement constant with 10% seashell powder and replacing the fine aggregate with wood dust. The test results are as follows.

Table 5.3 Concrete compressive test results with both seashell powder and wooddust

% of Wood dust replaced with fine aggregate	Average compressive strength at 7 days (N/mm2)	Average compressive strength at 28 days (N/mm2)
5	16.21	30.01
10	17.14	33.12
15	15.18	28.26

Figure 4.6 Compression value of 10% seashell powder and 10% wood dust

From the test results, it shows that replacing the cement with 10% seashell powder and fine aggregate with 10% wood dust shows higher strength compared to other specimens.

SPLIT TENSILE STRENGTH TEST

This is an indirect test to determine the tensile strength of cylindrical specimens.

Splitting tensile strength tests were carried out on cylinder specimens of size 150 mmdiameter and 300 mm length at the age of 7, 28 days curing. Test was performed as per IS 516:1959. Results are shown in table 5.4

Table 5.4 Spilt tensile strength of Seashell powder concrete

% of Seashell powder replaced with cement	Average split tensilestrength at 7 days (N/mm2)	Average split tensilestrength at 28 days (N/mm2)
0	2.41	3.33
5	3.11	4.25

10	3.45	4.39
15	3.26	4.13

Figure 5.4 Split tensile strength of cylindrical concrete specimen

Results from the test shows that when cement replaced with 10% seashell powder hashigher capacity to withstand tension in the concrete.

WORKABILITY TEST

The Workability of the concrete is measured using the slump cone test. The apparatusconsists of a metallic mould in the form of a frustum of a cone having the internal dimensions as bottom diameter 200 mm, top diameter 100 mm and height 300 mm along with tamper 16 mm in diameter and 600 mm length.

Test are performed as per IS 7320:1974 Specifications for concrete slump test apparatus.

Table 5.5 Slump value of seashell powder concrete

% of Seashell powder replaced with cement	Slump (mm)
0	100
5	95
10	85
15	70


Figure 5.5 Slump Cone Test

CONCLUSION

The physical test for various construction materials and chemical analysis has been done for Seashell powder and wood dust. From this the properties of the seashells and its powder form is determined. It has been found that its composition is filled upwith cementitious materials. From the physical and chemical tests, it is concluded that the addition of Seashell powder and Wood dust as an alternate material for concrete can be done. Initially, conventional M25 cubes were cast and tested to compare the results of various replacements. The 10% replaced seashell powder concrete showed good results compared to other replacements. Partial replacement ofwood ash with sand up to 15% is effective. Compressive strength and split tensile strength was found to be good when compared to control concrete. The addition of wood dust makes the concrete lightweight. Wood dust powder replacement with sand for 5%, 10%, 15% was found to be higher than conventional concrete. Using seashell powder and wood dust as replacement is cost-effective, user friendly, and higher strength. The optimum performance was found at a 10% replacement of wood dust with sand. From this, it is known that seashell powder and wood dust can be partiallyreplaced for cement and sand and it can be considered as an alternative.

REFERENCES

1. A.E. Richardson, T. Fuller, Sea shells used as partial aggregate replacement in concrete structures. Survey 31 (5) (2013) 347–354.
2. Ali, Maisarah & Abdullah, Muhd & Saad, Siti. (2015). "Effect of Calcium Carbonate Replacement on Workability and Mechanical Strength of PortlandCement Concrete". Advanced Materials Research. 1115. 137-141.
3. B.Y. Zhong, Q. Zhou, C.F. Chan, Y. Yu, Structure and propertycharacterization of oyster shell cementing material, Chin. J. Struct. Chem. 31(1) (2012) 85–92.
4. Dilip Kumar, Smita Singh, Neetesh Kumar and Ashish Gupta. (2014)." Low Cost Construction Material for Concrete as Sawdust "Global Journal of Researches in Engineering Civil And Structural Engineering Volume 14 Issue 4 Version 1.0, ISSN: 2249-4596.
5. E.I. Yang, S.T. Yi, Y.M. Leem, Effect of oyster shell substituted for fine Aggregate on concrete characteristics: Part I. Fundamental properties, Cem. Concr. Res.35 (2005) 2175–2182.
6. IS 2386-Part 1 2003 Methods of test for aggregates for concrete.
7. IS Code 269 : 1989 for Ordinary Portland Cement
8. K. Muthusamy, N.A. Sabri, Cockle shell: a potential coarse aggregate replacement in concrete, Int. J. Sci. Environ. Technol. 1 (4) (2012) 260–267.
9. M.R. Ponnada, S.S. Prasad, H. Dharmala, Compressive strength of concrete with partial replacement of aggregates with granite powder and cockleshell,Malaysian J. Civil Eng. 28 (2) (2016) 183–204.
10. M.S. Shetty, Concrete Technology: Theory and Practice, sixth revised ed., S.Chand, New Delhi, India, 2012.
11. Monita Olivia, RevinaOktaviani and Ismeddiyanto (2016). "Properties of Concrete containing ground waste cockle and clam Seashells " Science Direct Procedia Engineering 658 – 663.
12. P.Sasi kumar , C.Suriya kumar and Er.K.Jegan Mohan.(2016). "A Partial Replacement for Coarse Aggregate by Sea Shell and Cement by Lime in Concrete" Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-5, ISSN: 2454-1362.
13. S.A. Raji and A.T.Samuel .(2015). "Egg Shell As A Fine Aggregate In Concrete For Sustainable Construction" International Journal of Scientific &Technology Research Volume 4, Issue 09, ISSN 2277-8616.
14. T. Soneye, A.N. Ede, G.O. Bamigboye, D.O. Olukanni, The study of periwinkle shells as fine and coarse aggregate in concrete works. In: 3rd InternationalConference on African Development Issues, 2016, pp. 361–364.ISSN: 2449-075X.
15. UchechiG.Eziefula , John and BennetI.Eziefula.(2018)."Properties of seashell aggregate concrete "Construction and Building Materials" Volume 192, Pages 287-300.
16. Velmurugan and Jose Ravindraraj.(2017). "Effect on Strength Properties of M30 Grade of Concrete by Using Waste Wood Powder as Partial Replacement of Sand "International Journal of Engineering and ManagementResearch Volume-7, Issue-2, Page Number: 301-305.