International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal,Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. Twobillionofaggregateareproducedeachyearinthe UnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.

Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-

Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.

After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.

Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.

To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.

To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	**RESULTS**
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

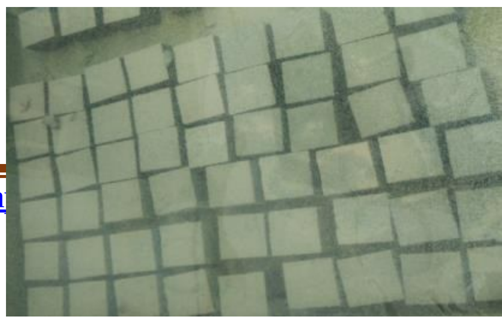
Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes



International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	**Grade of concrete**	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

S.No	**Grade of concrete**	**Flexural strength Of 7 days (Mpa)**	**Flexural Strength of 14 days (Mpa)**	**Flexural Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

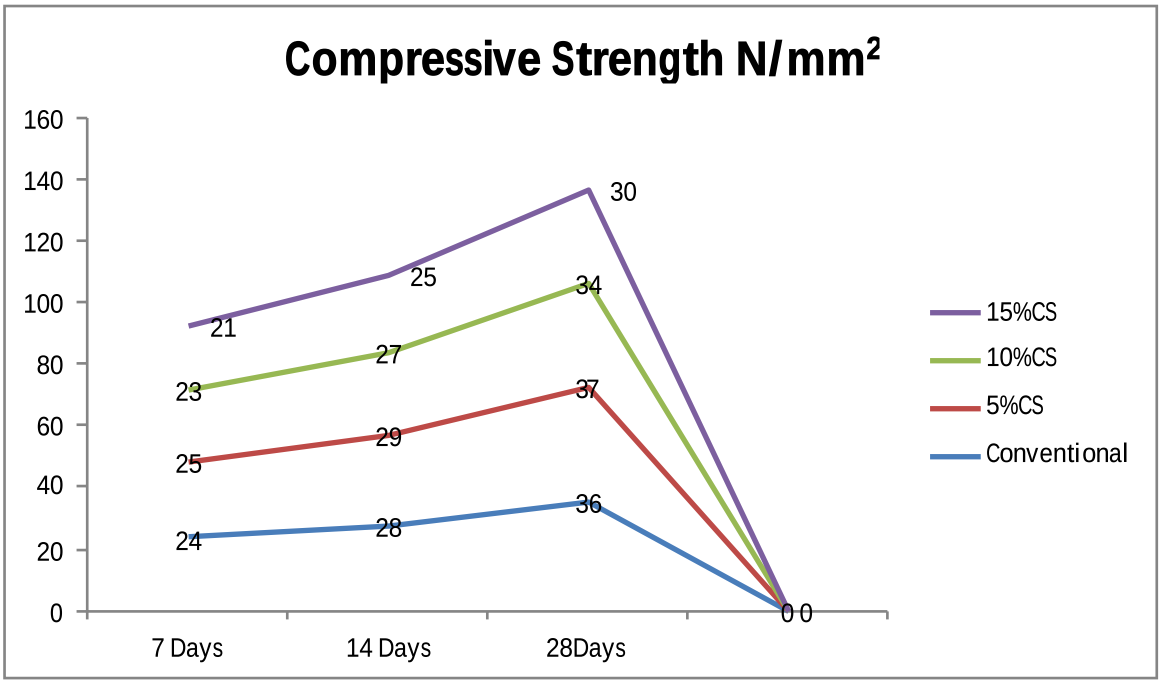
TENSILE TEST:

S.No	**Grade of concrete**	**Split- tensile strength Of 7 days (Mpa)**	**Split-tensile strength Of 14 days (Mpa)**	**Split- tensile Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

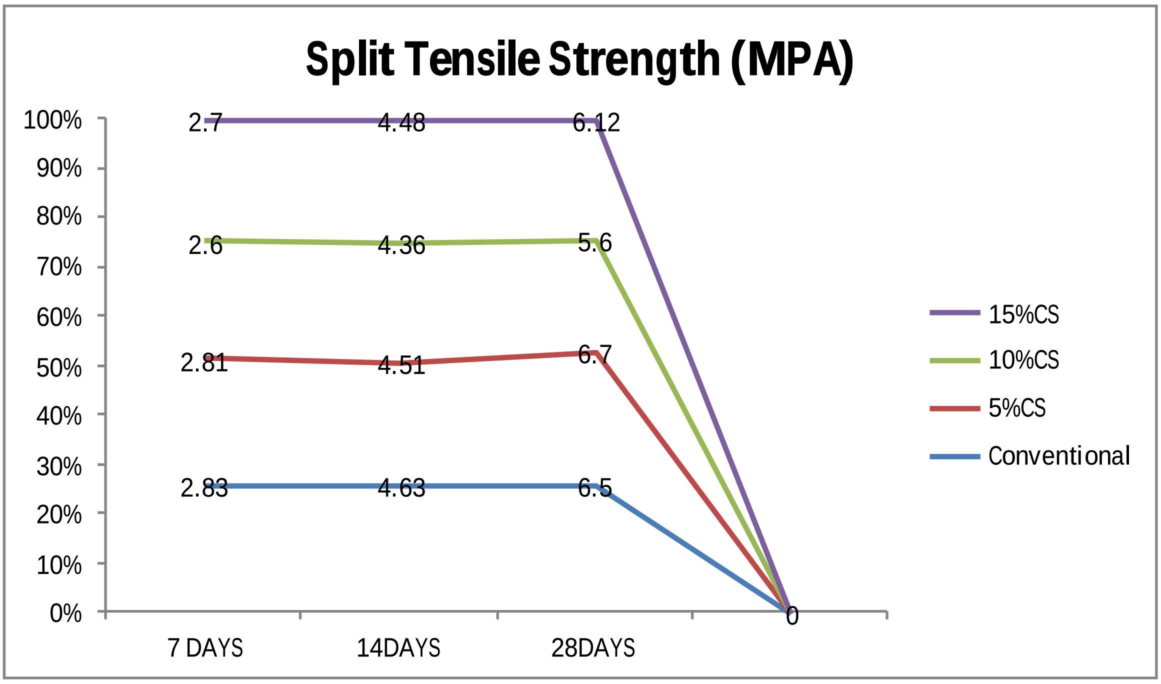
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

GRAPHS:

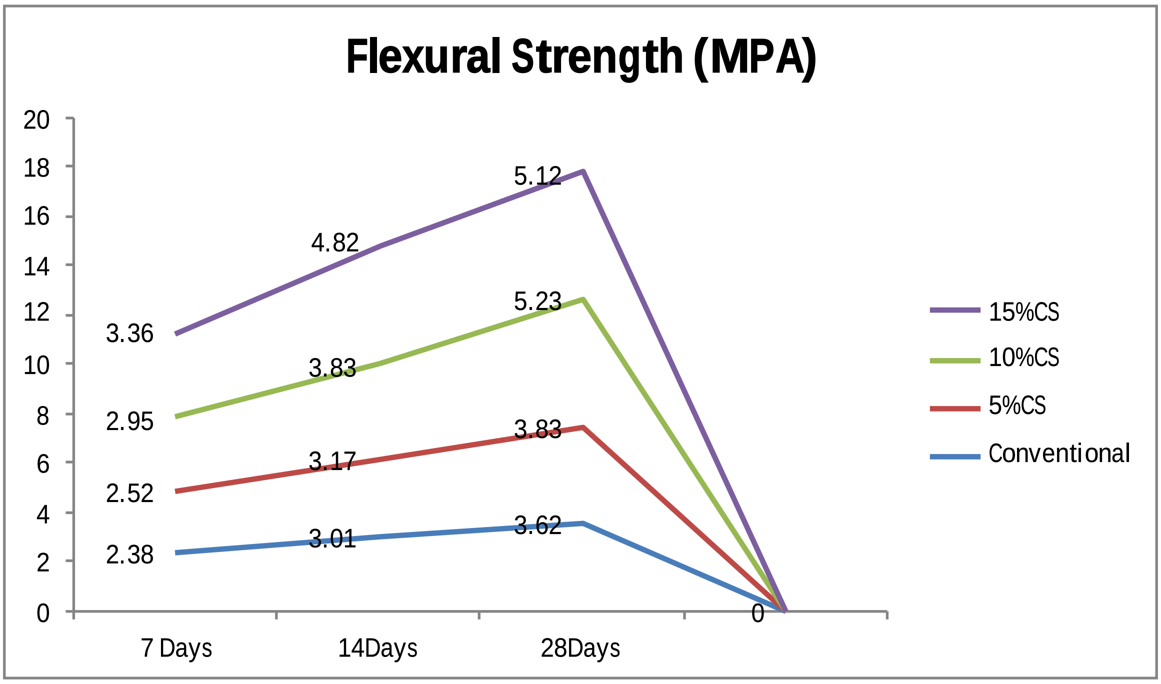
Compressive strength:



Split Tensile Strength:



Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, "A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates". Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, "Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review". National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, "Propertiesofconcrete with coconut shell as aggregate replacement". International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

International Journal of Research
Available at https://edupediapublications.org/journals

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. Twobillionofaggregateareproducedeachyearintheunitedstates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

International Journal of Research
Available at https://edupediapublications.org/journals

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

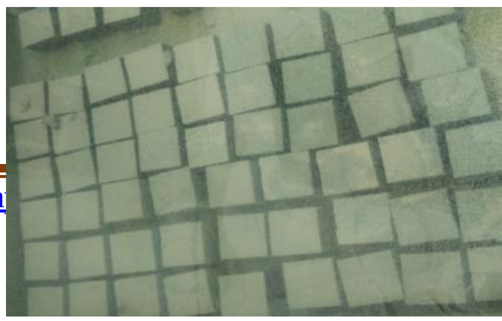


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	**Grade of concrete**	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

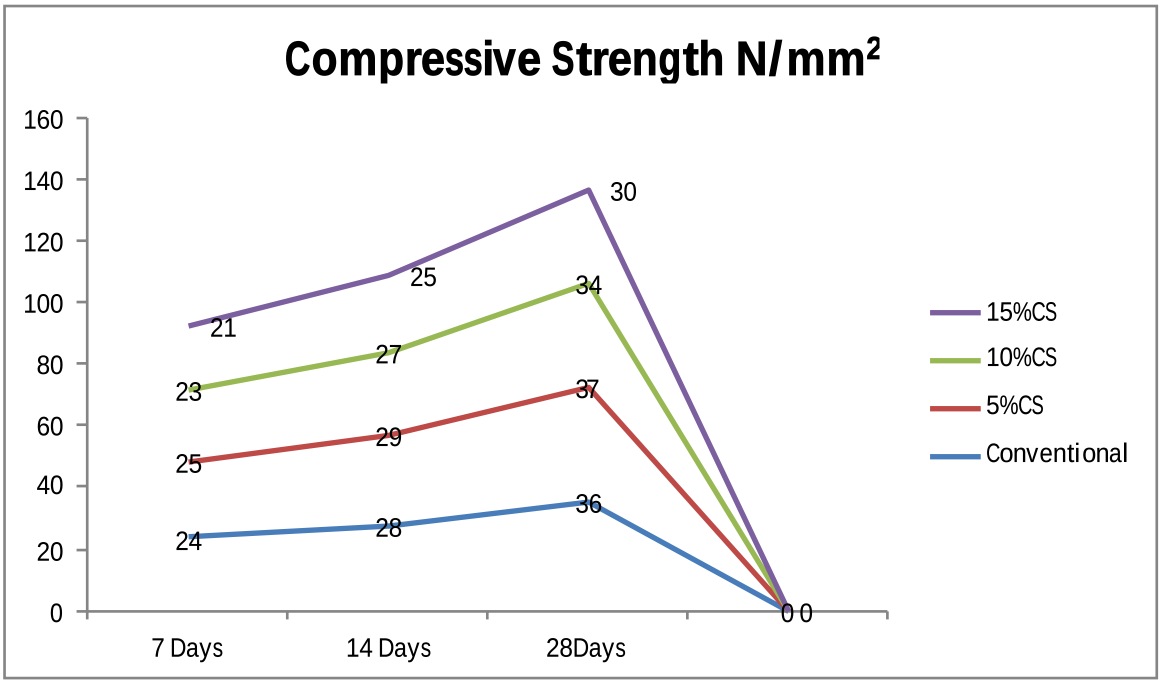
S.No	**Grade of concrete**	**Flexural strength Of 7 days (Mpa)**	**Flexural Strength of 14 days (Mpa)**	**Flexural Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

TENSILE TEST:

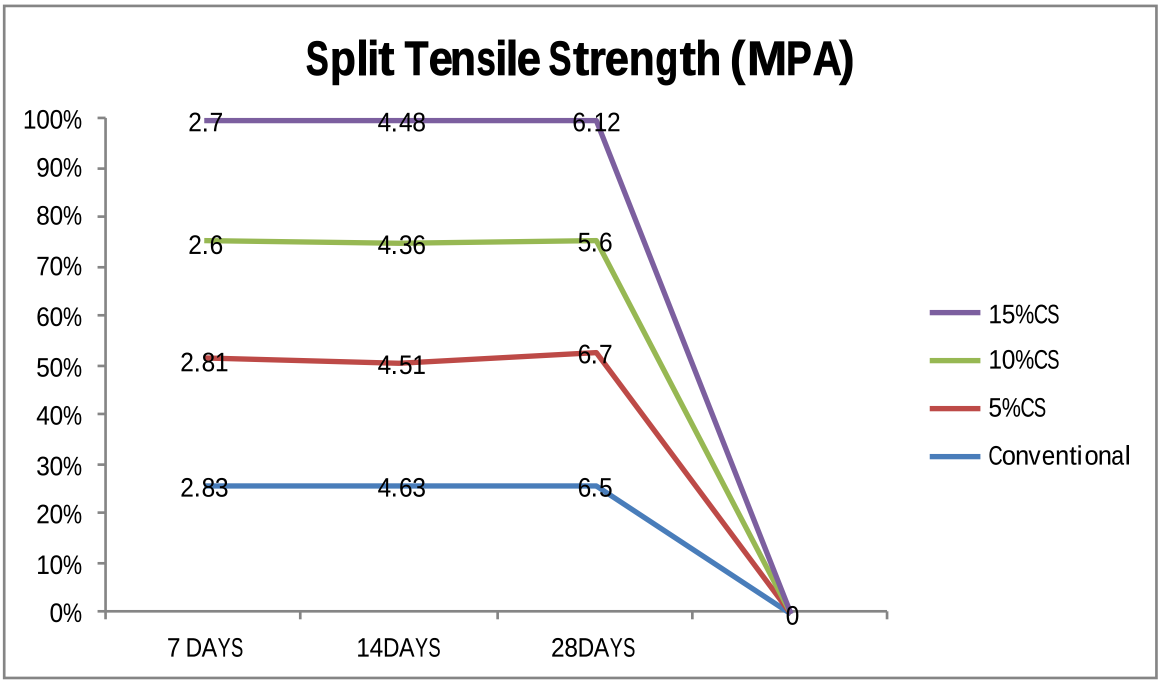
S.No	**Grade of concrete**	**Split- tensile strength Of 7 days (Mpa)**	**Split-tensile strength Of 14 days (Mpa)**	**Split- tensile Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

GRAPHS:
Compressive strength:

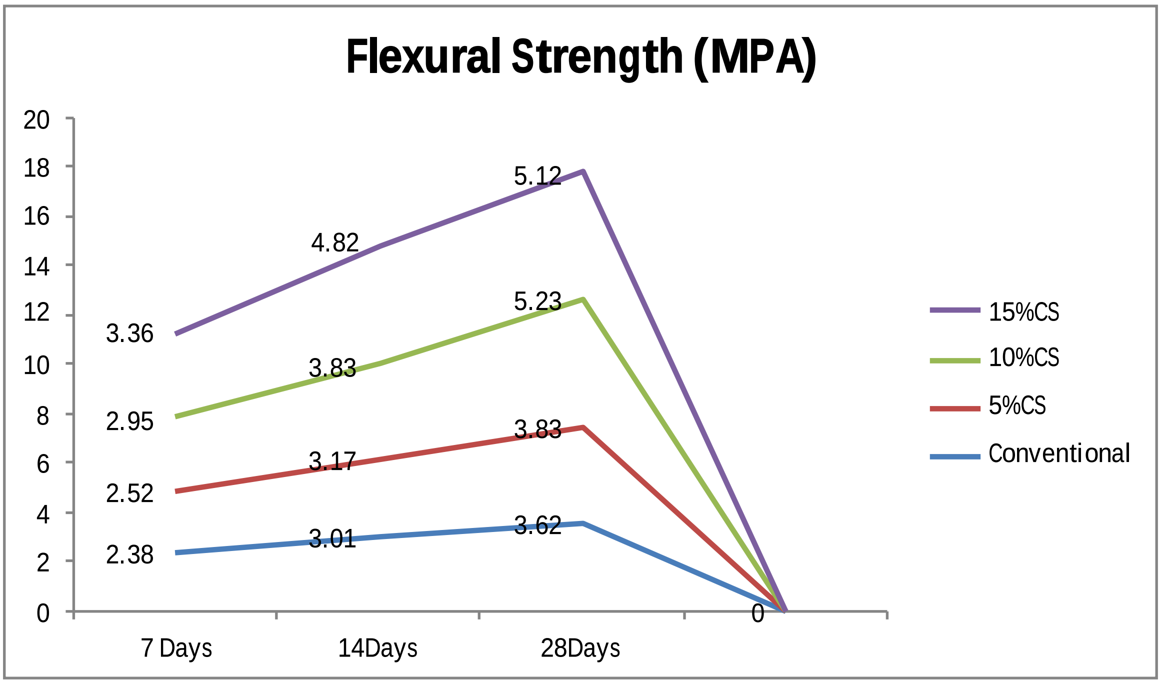


Split Tensile Strength:



International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, "A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates". Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, "Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review". National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, "Propertiesofconcrete with coconut shell as aggregate replacement". International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. TwobillionofaggregateareproducedeachyearintheUnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.
Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

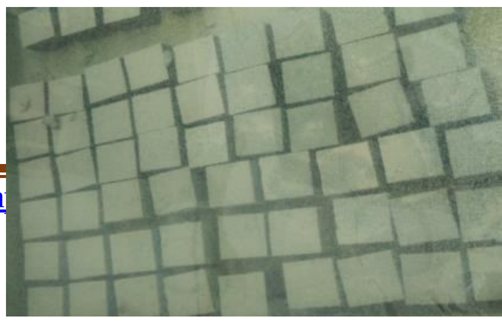


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	Grade of concrete	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

S.No	Grade of concrete	Flexural strength Of 7 days (Mpa)	Flexural Strength of 14 days (Mpa)	Flexural Strength of 28 days (Mpa)
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

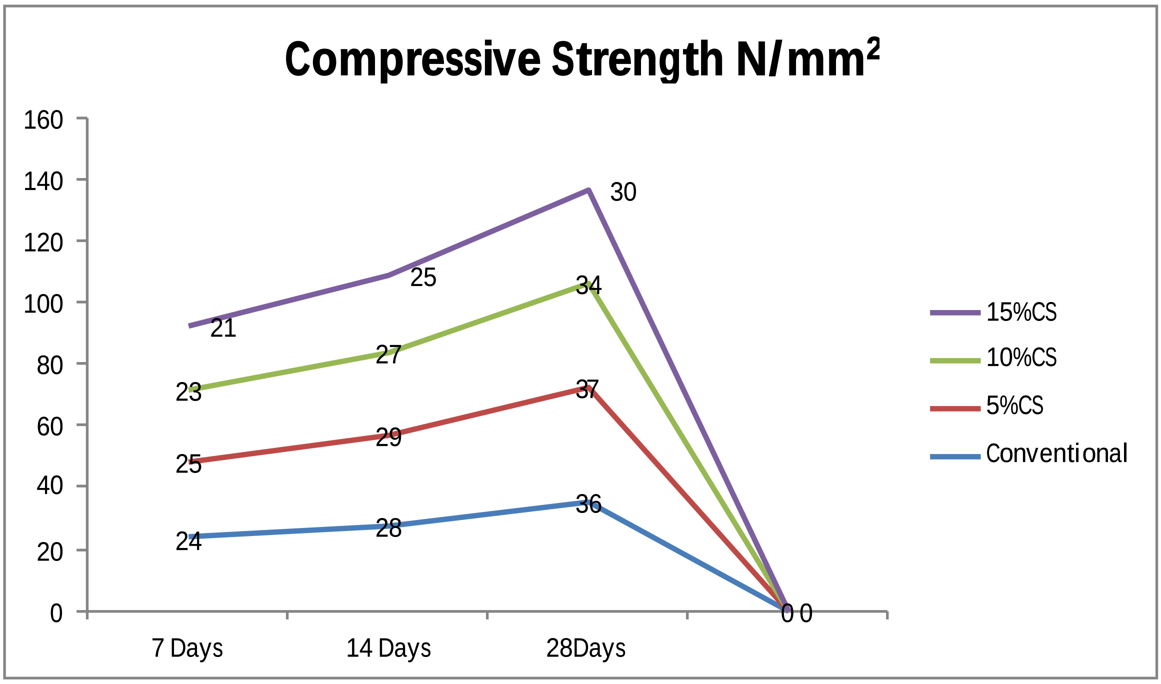
TENSILE TEST:

S.No	Grade of concrete	Split- tensile strength Of 7 days (Mpa)	Split-tensile strength Of 14 days (Mpa)	Split- tensile Strength of 28 days (Mpa)
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

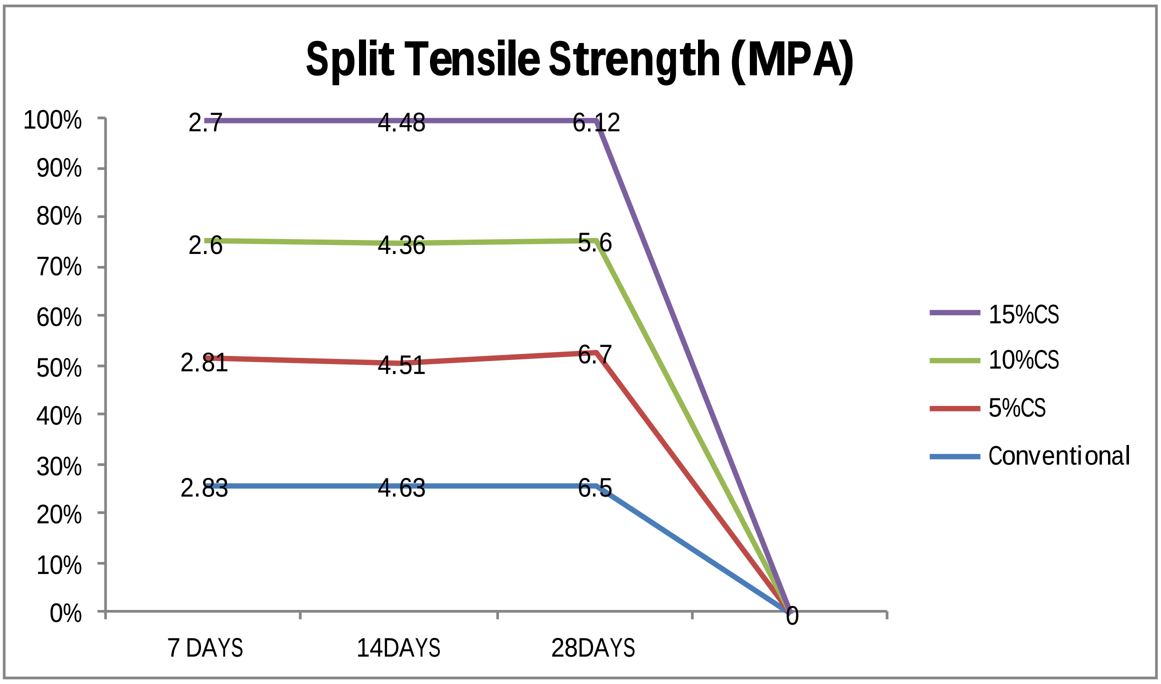
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

GRAPHS:

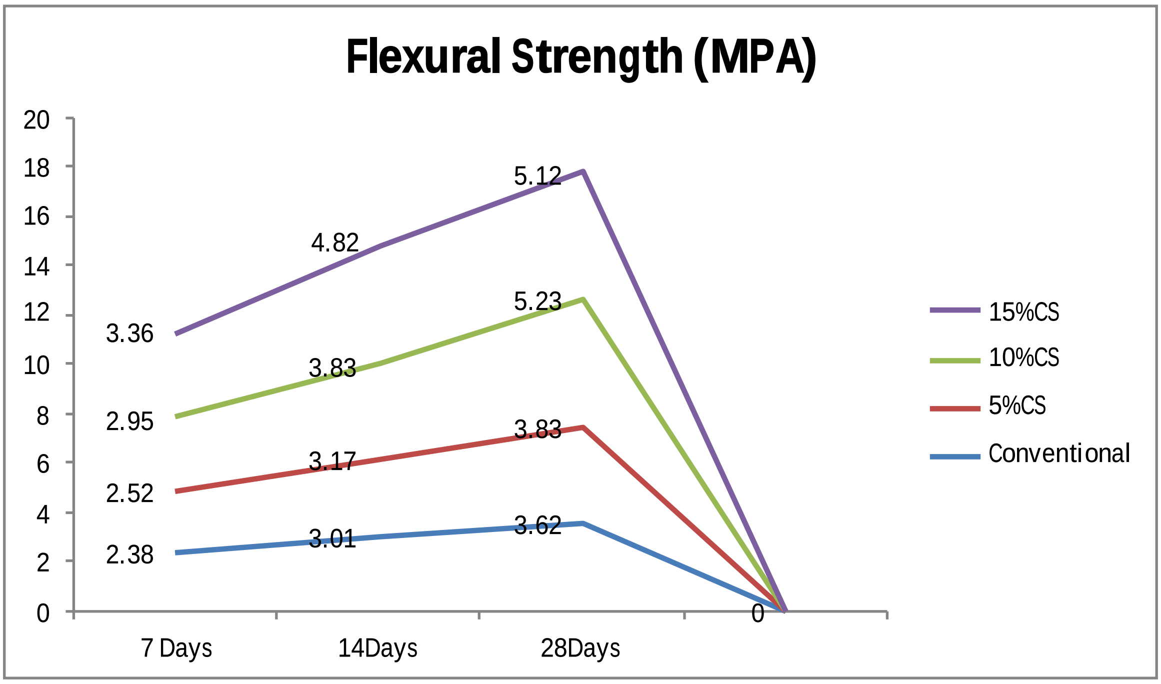
Compressive strength:



Split Tensile Strength:



Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, “A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates”. Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, “Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review”. National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, “Propertiesofconcrete with coconut shell as aggregate replacement”. International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. TwobillionofaggregateareproducedeachyearintheUnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

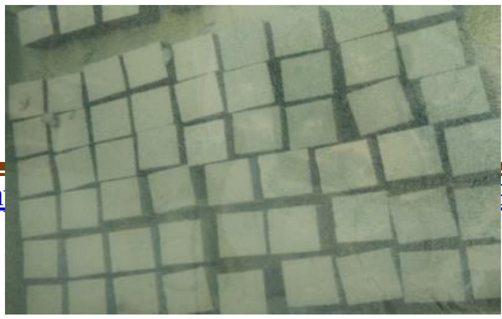
Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes



International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	**Grade of concrete**	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

S.No	**Grade of concrete**	**Flexural strength Of 7 days (Mpa)**	**Flexural Strength of 14 days (Mpa)**	**Flexural Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

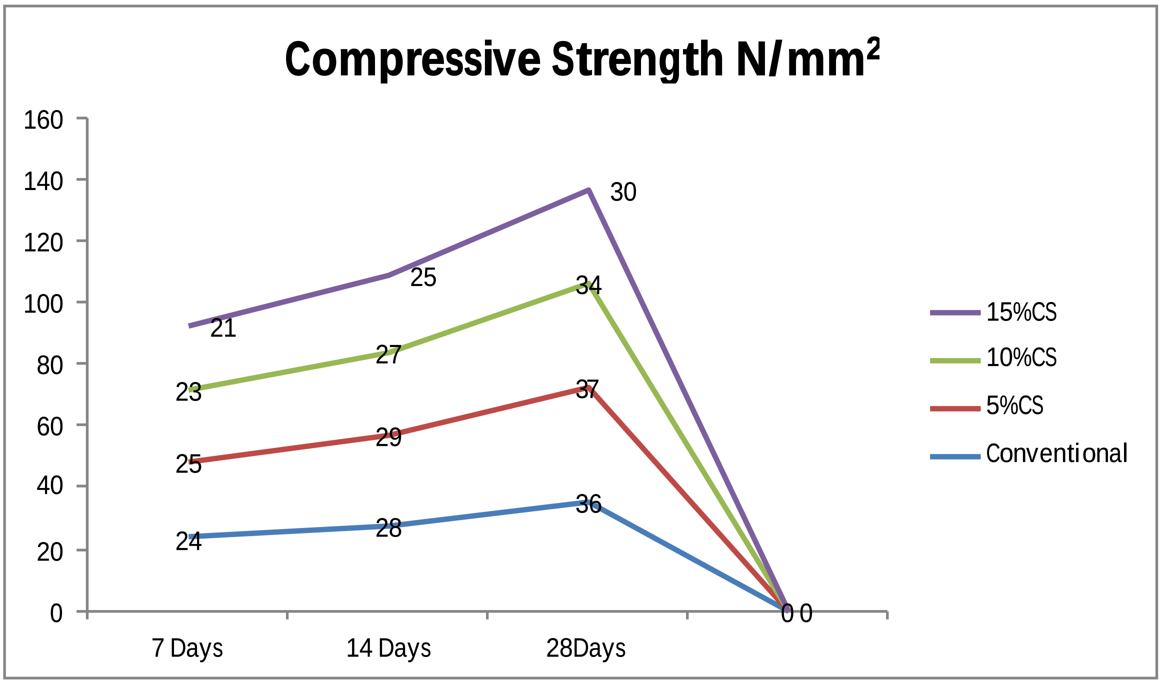
TENSILE TEST:

S.No	**Grade of concrete**	**Split- tensile strength Of 7 days (Mpa)**	**Split-tensile strength Of 14 days (Mpa)**	**Split- tensile Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

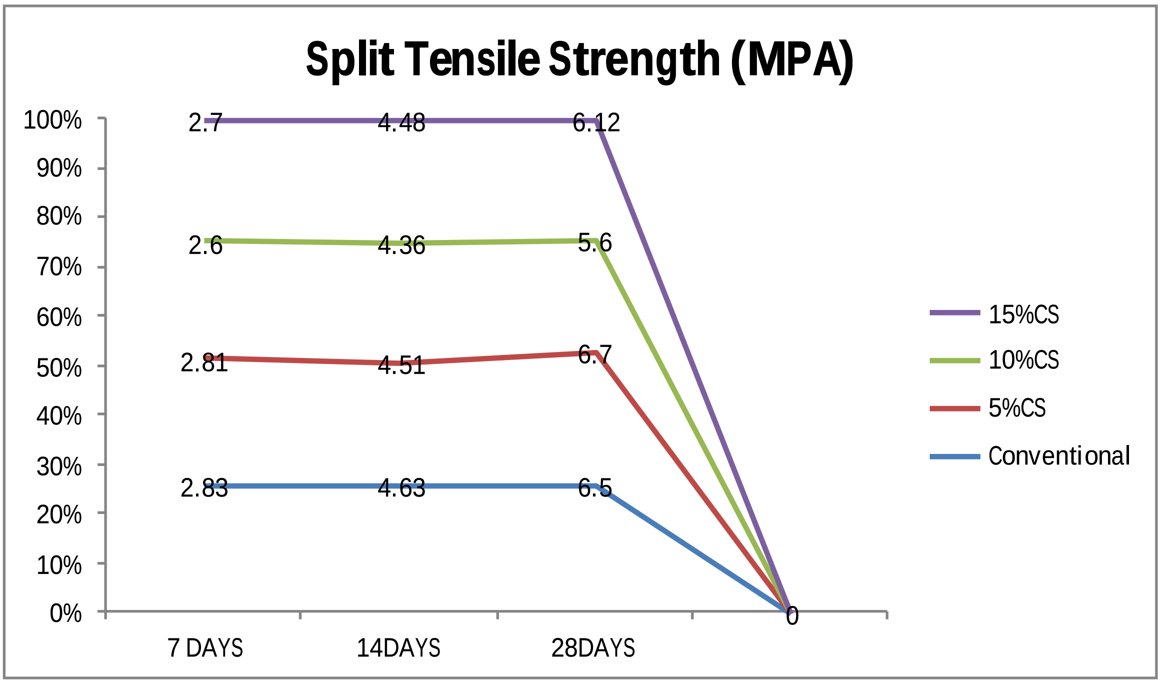
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

GRAPHS:

Compressive strength:

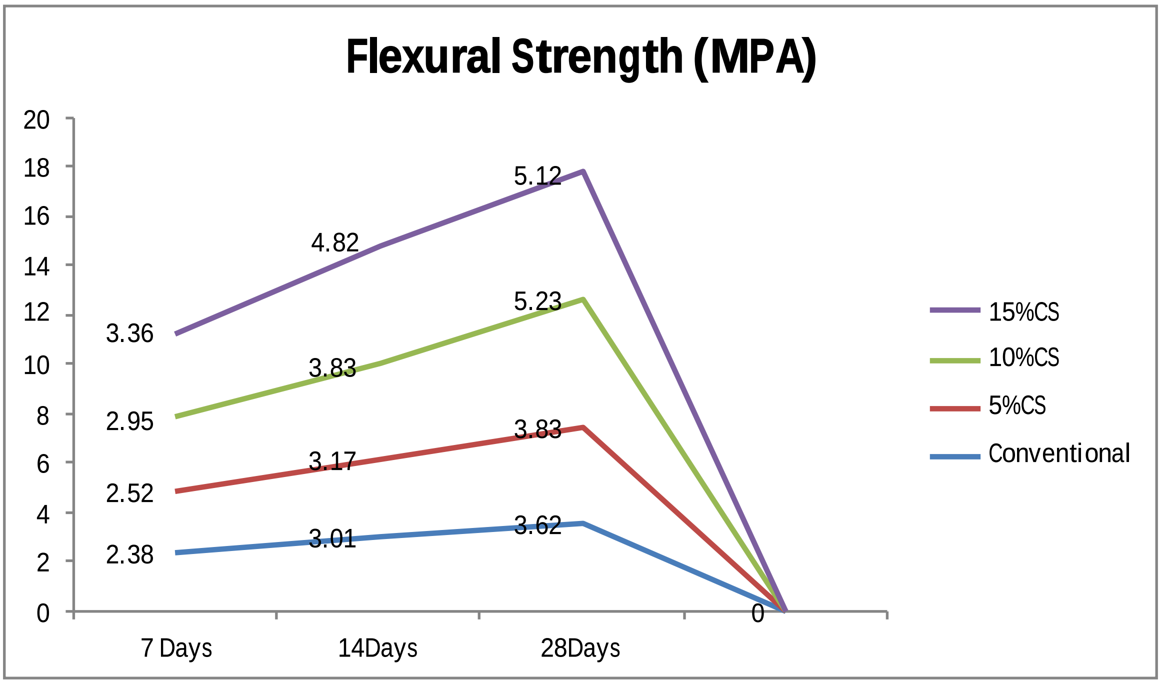


Split Tensile Strength:



International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, "A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates". Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, "Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review". National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, "Propertiesofconcrete with coconut shell as aggregate replacement". International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal,Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. Twobillionofaggregateareproducedeachyearinthe UnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.

In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.

Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.

Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

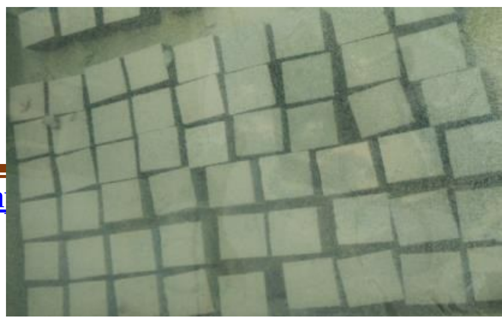


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	**Grade of concrete**	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

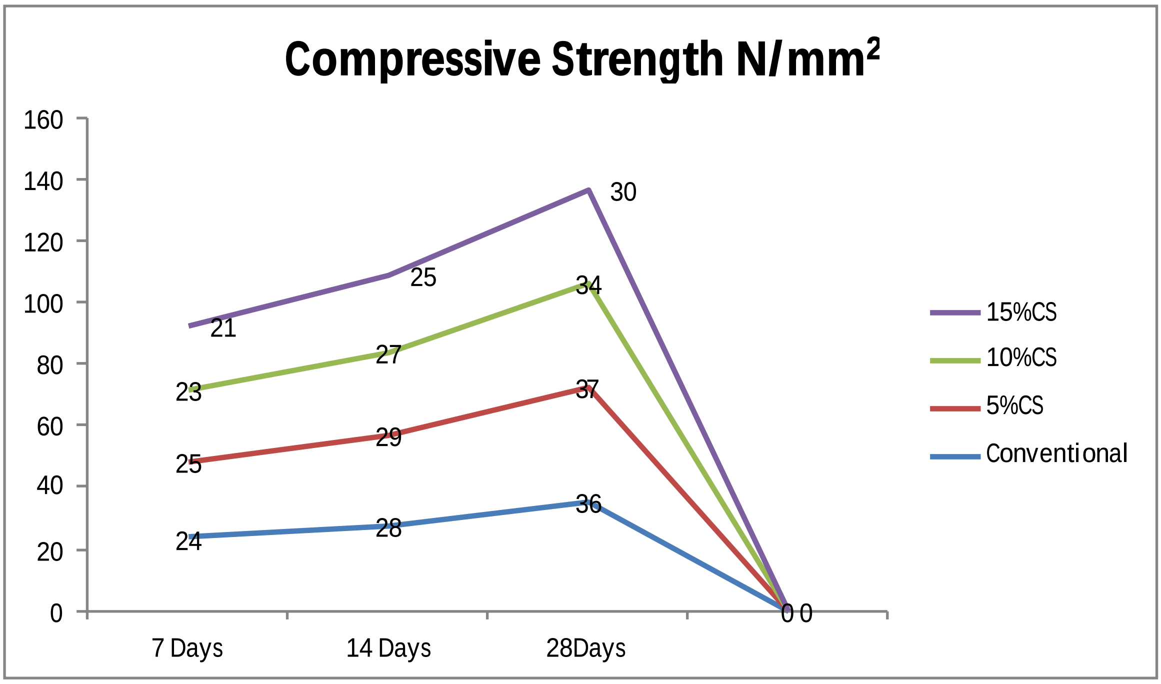
FLEXURAL TEST:

S.No	**Grade of concrete**	**Flexural strength Of 7 days (Mpa)**	**Flexural Strength of 14 days (Mpa)**	**Flexural Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

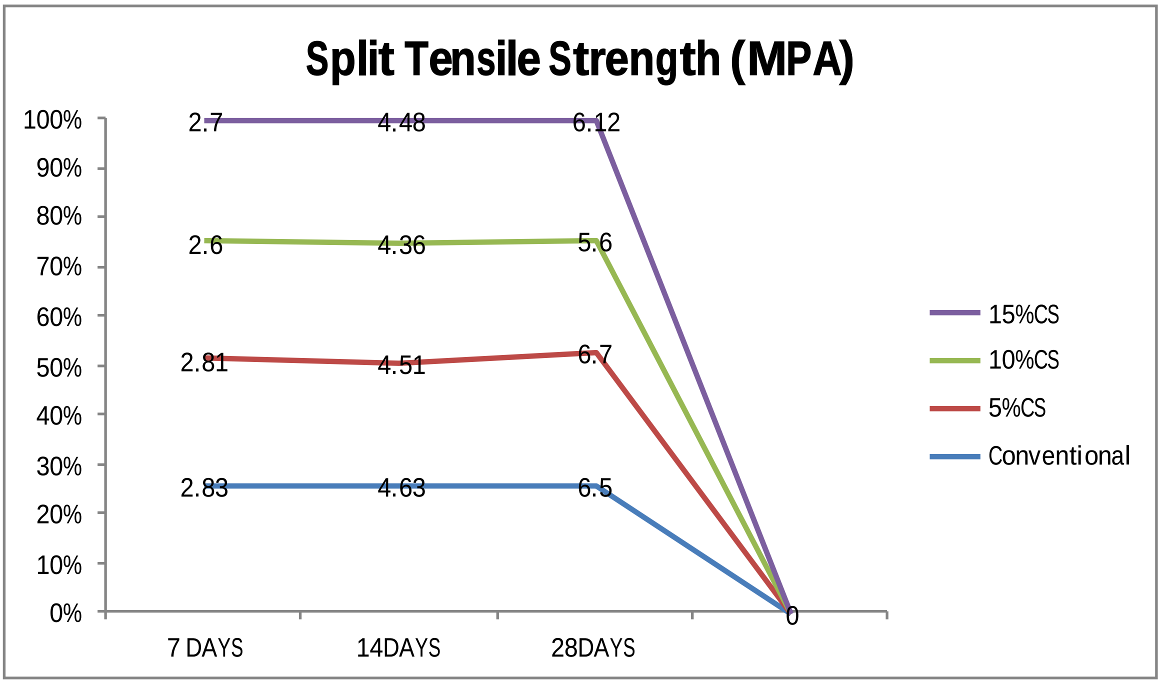
TENSILE TEST:

S.No	**Grade of concrete**	**Split- tensile strength Of 7 days (Mpa)**	**Split-tensile strength Of 14 days (Mpa)**	**Split- tensile Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

GRAPHS:
Compressive strength:

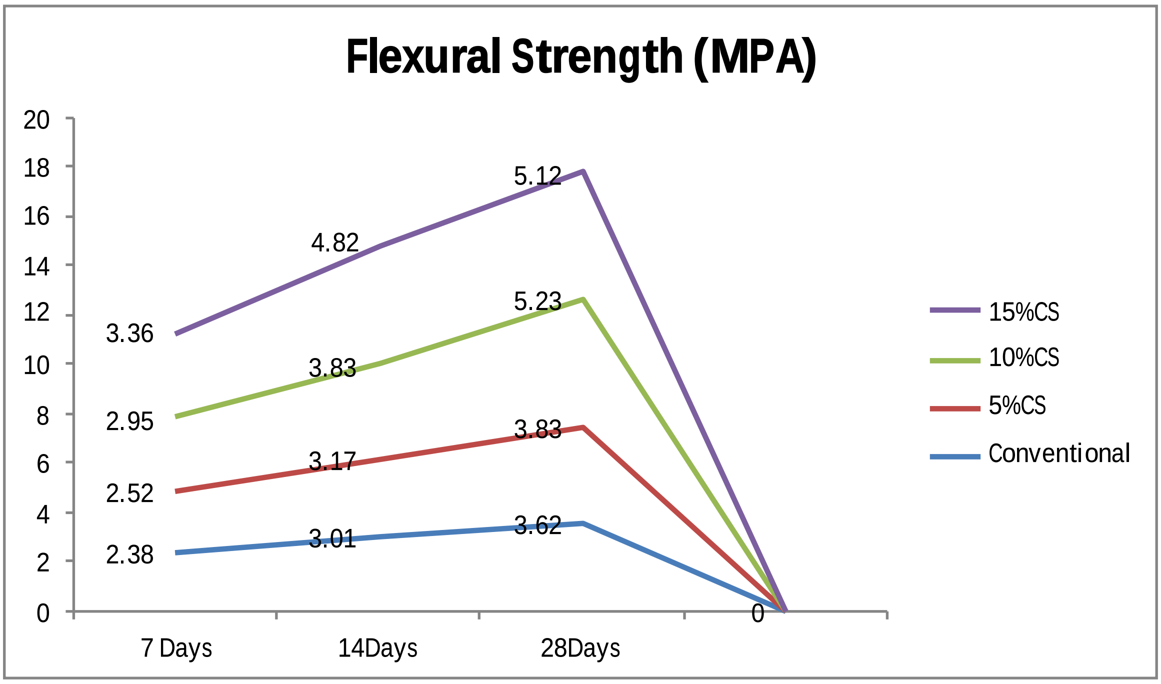


Split Tensile Strength:



International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, “A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates”. Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, “Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review”. National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, “Propertiesofconcrete with coconut shell as aggregate replacement”. International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. TwobillionofaggregateareproducedeachyearintheUnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.

In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.

Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.

Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

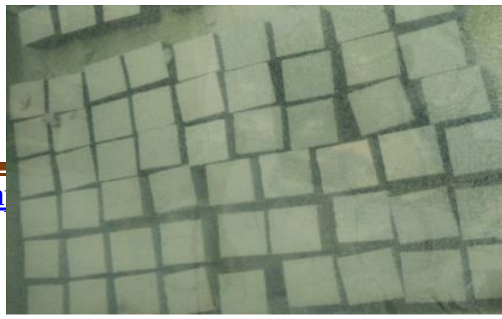


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

TEST RESULTS:

Compressive strength test results:

S.No	Grade of concrete	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

S.No	Grade of concrete	Flexural strength Of 7 days (Mpa)	Flexural Strength of 14 days (Mpa)	Flexural Strength of 28 days (Mpa)
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

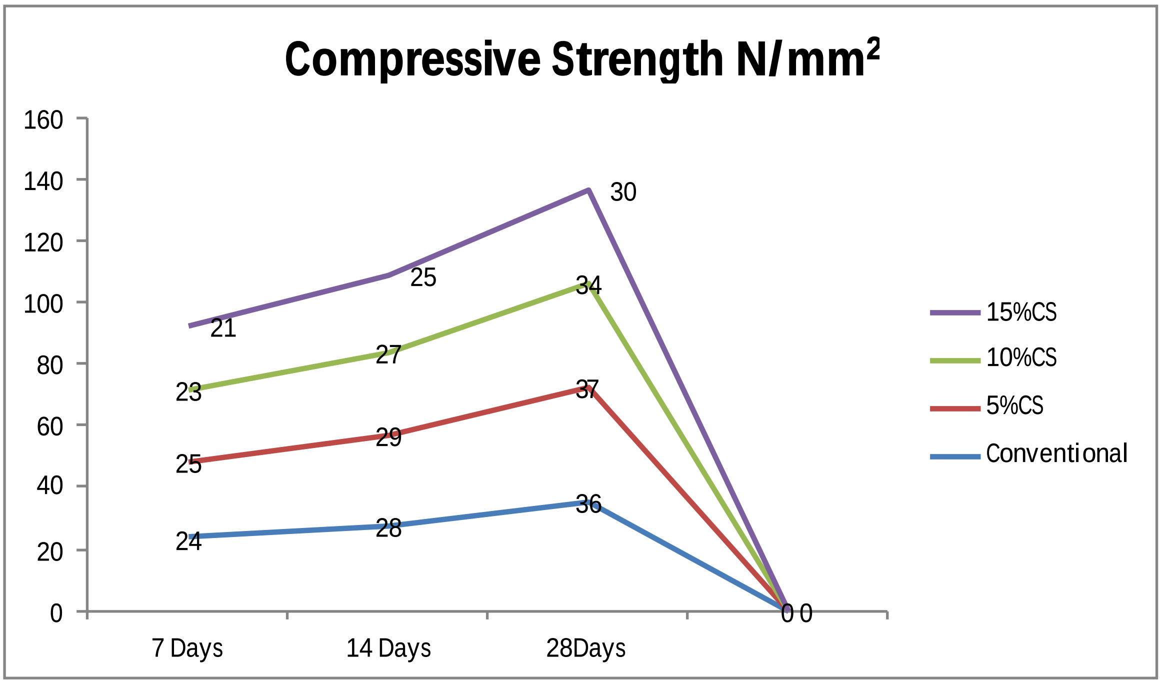
TENSILE TEST:

S.No	Grade of concrete	Split- tensile strength Of 7 days (Mpa)	Split-tensile strength Of 14 days (Mpa)	Split- tensile Strength of 28 days (Mpa)
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

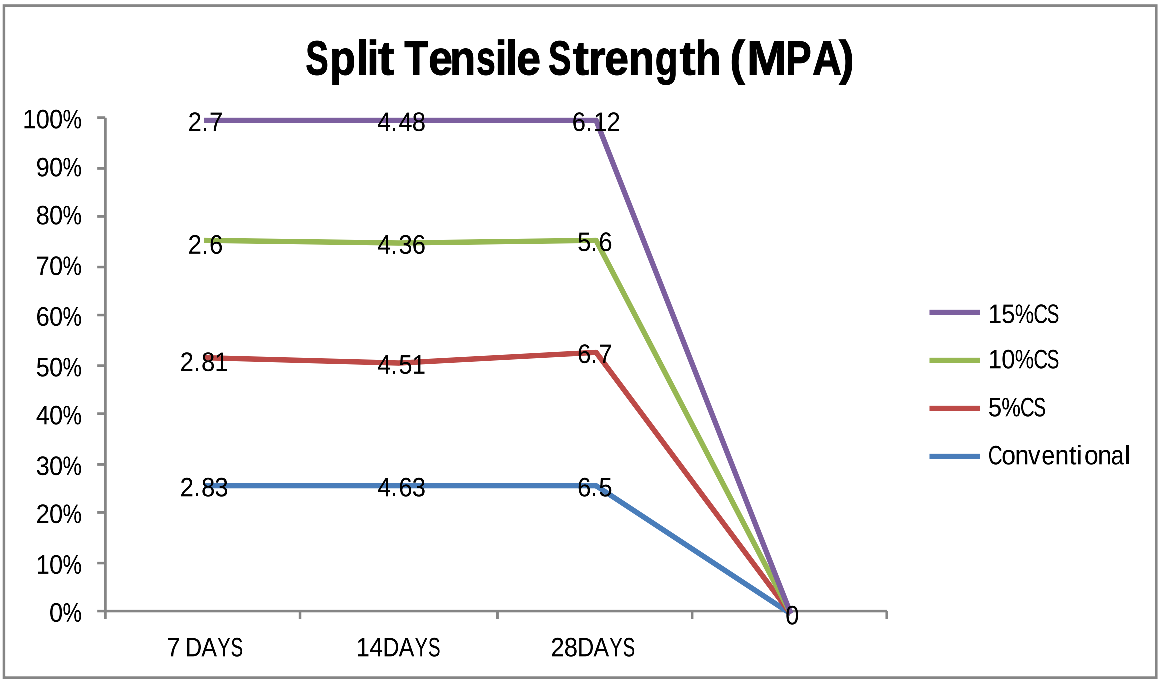
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

GRAPHS:

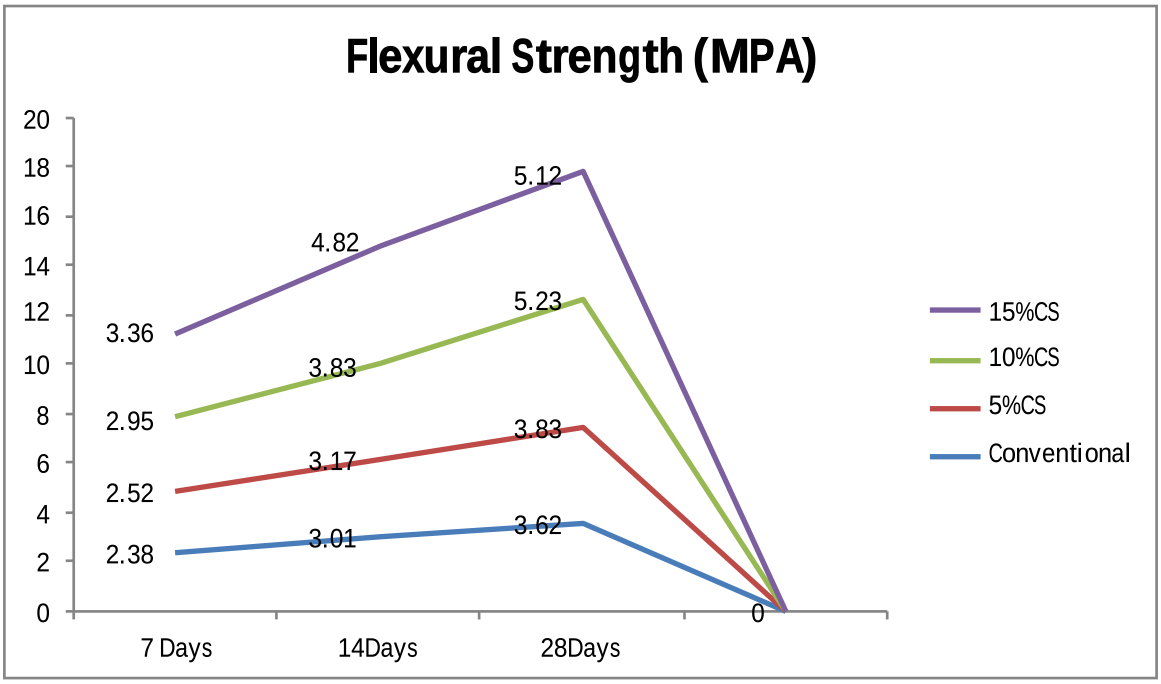
Compressive strength:



Split Tensile Strength:



Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, “A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates”. Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, “Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review”. National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, “Propertiesofconcrete with coconut shell as aggregate replacement”. International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. Twobillionofaggregateareproducedeachyearin theUnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.

Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-

Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.

After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.

Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.

To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.

To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

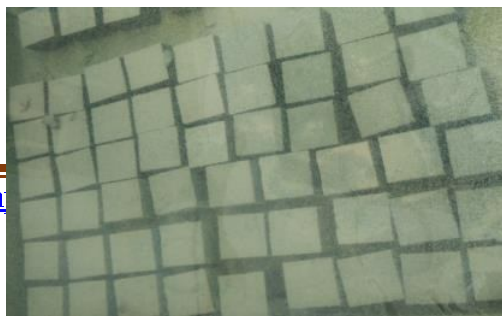


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	**Grade of concrete**	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

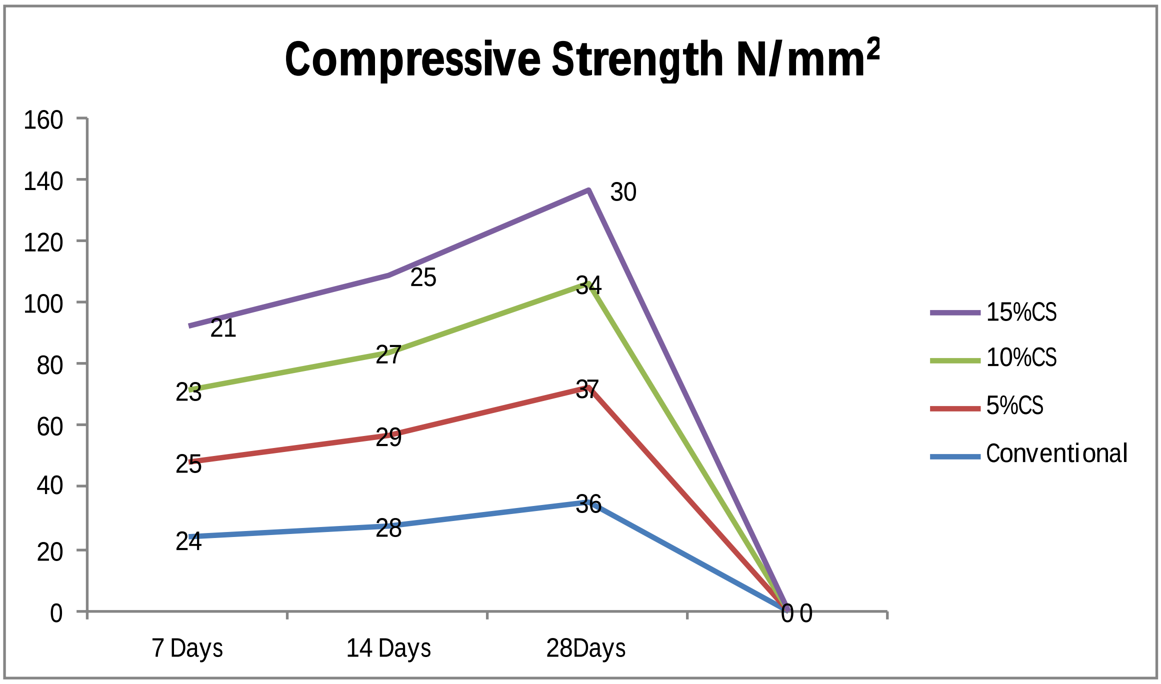
S.No	**Grade of concrete**	**Flexural strength Of 7 days (Mpa)**	**Flexural Strength of 14 days (Mpa)**	**Flexural Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

TENSILE TEST:

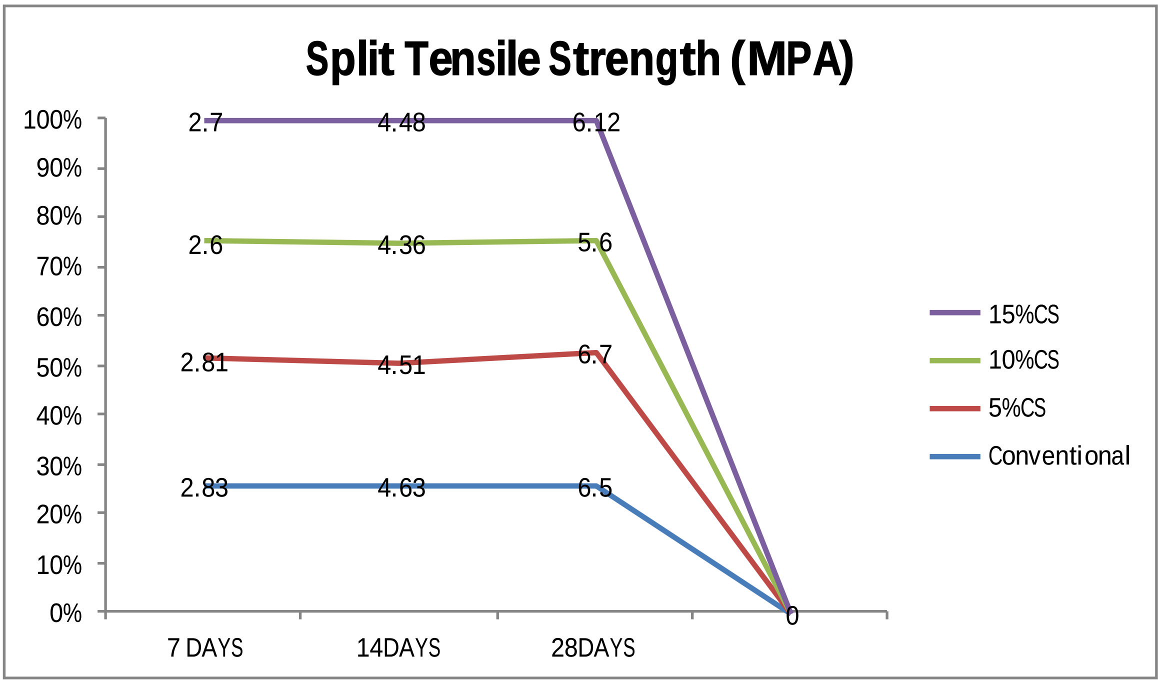
S.No	**Grade of concrete**	**Split- tensile strength Of 7 days (Mpa)**	**Split-tensile strength Of 14 days (Mpa)**	**Split- tensile Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

GRAPHS:

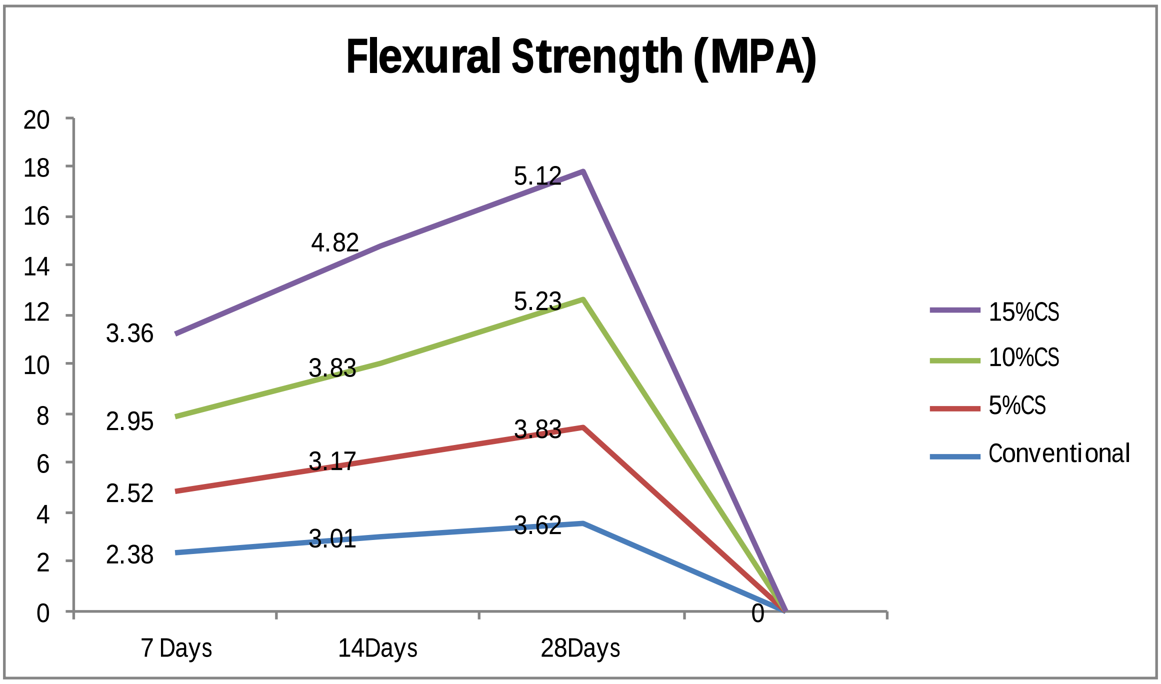
Compressive strength:



Split Tensile Strength:



Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, "A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates". Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, "Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review". National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, "Propertiesofconcrete with coconut shell as aggregate replacement". International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh,India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. TwobillionofaggregateareproducedeachyearintheUnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.

Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	**RESULTS**
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min

Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

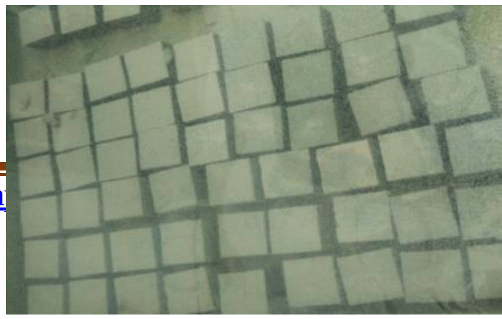


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	Grade of concrete	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

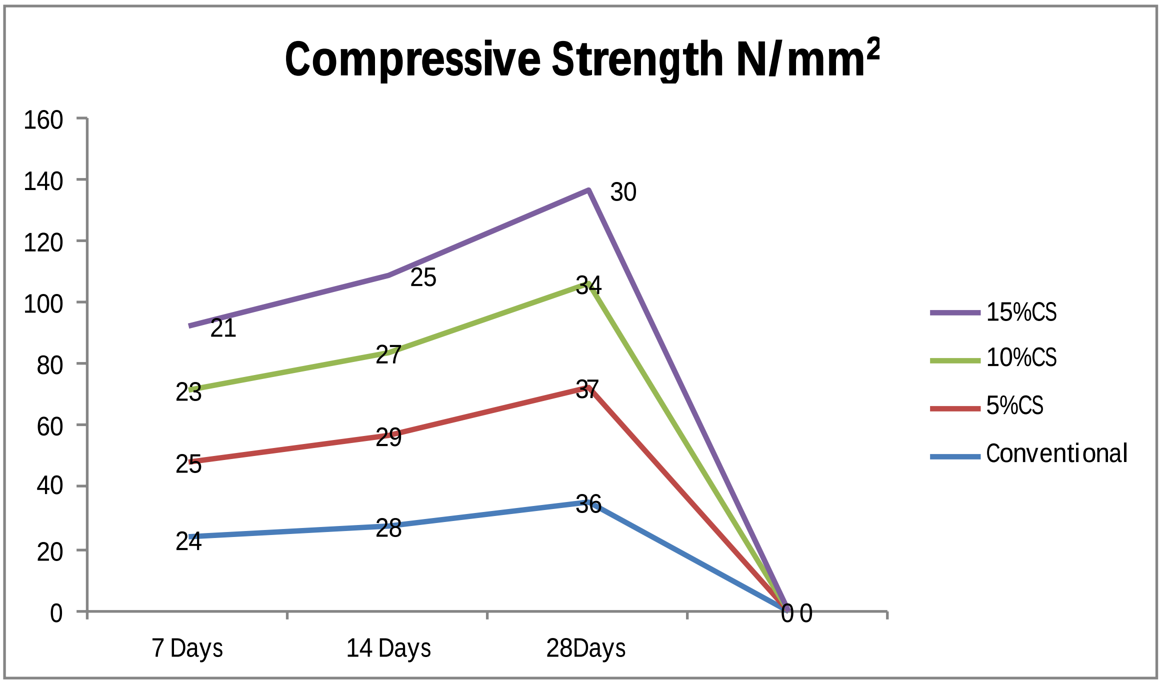
S.No	Grade of concrete	Flexural strength Of 7 days (Mpa)	Flexural Strength of 14 days (Mpa)	Flexural Strength of 28 days (Mpa)
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

TENSILE TEST:

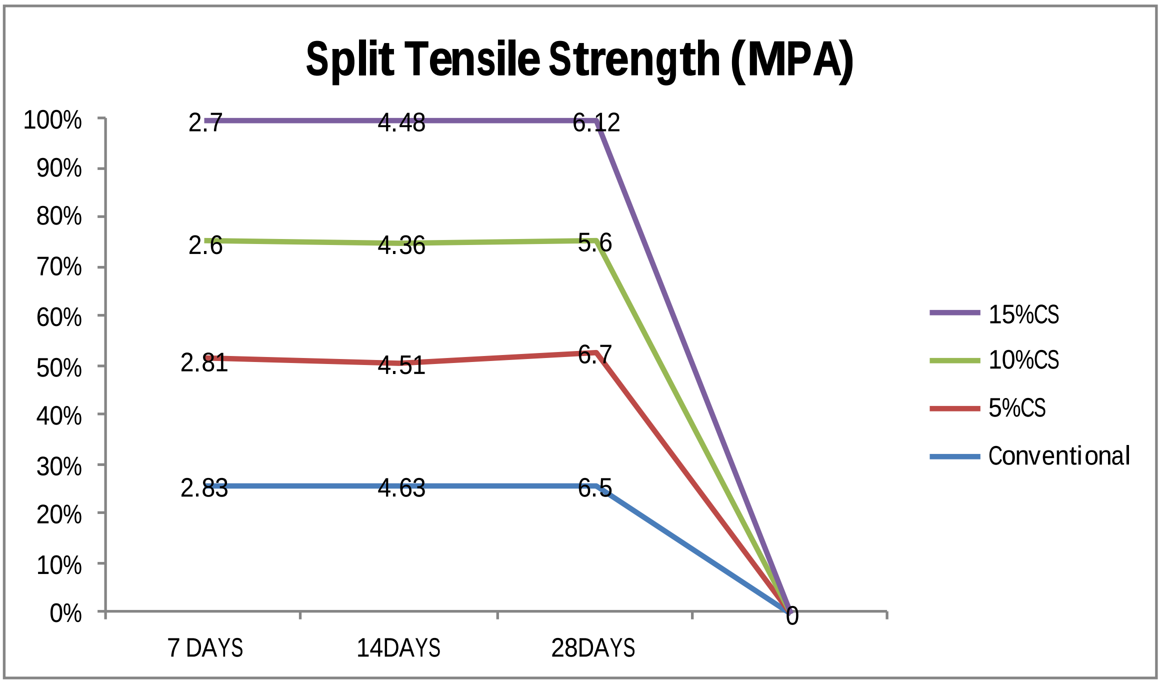
S.No	Grade of concrete	Split- tensile strength Of 7 days (Mpa)	Split-tensile strength Of 14 days (Mpa)	Split- tensile Strength of 28 days (Mpa)
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

GRAPHS:
Compressive strength:

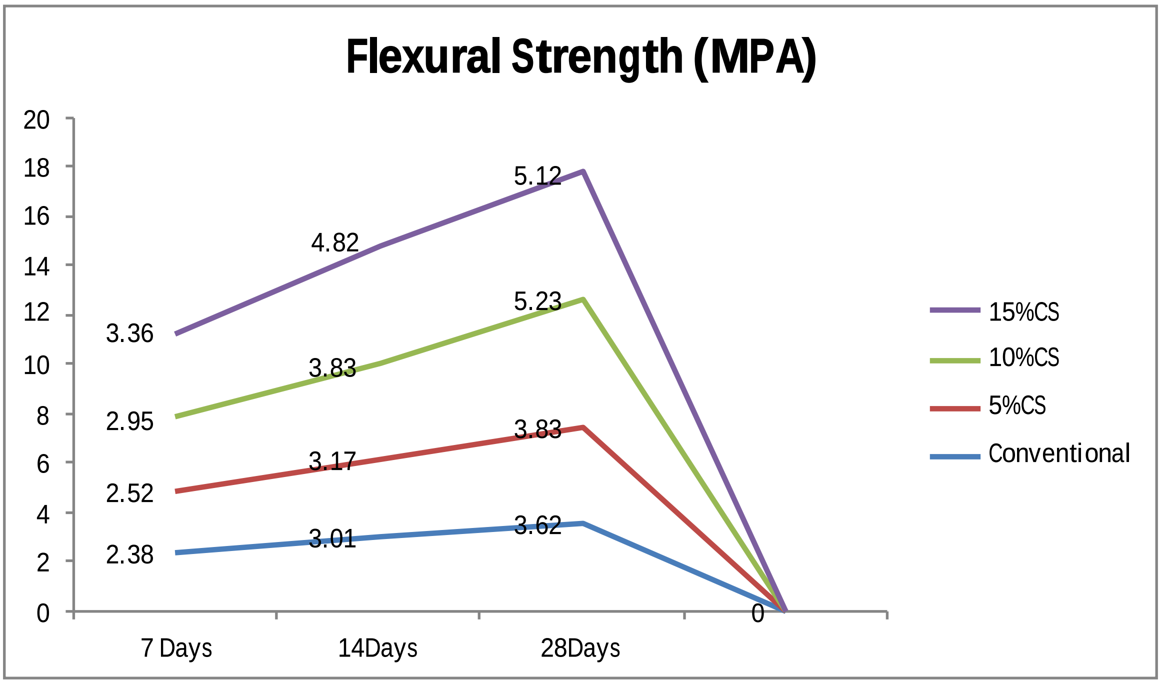


Split Tensile Strength:



International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, “A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates”. Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, “Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review”. National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, “Propertiesofconcrete with coconut shell as aggregate replacement”. International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Effect Of Coconutshell As A Partoal Replacement Of Coarse Aggregates On Strength Characteristics Of Concrete

Y S V Samantha received the B.Tech degree in civil engineering from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, JNTU KAKINADA, Andhra Pradesh, India, in 2016 year, and perusing M.Techin STRUCTURAL ENGINEERING from BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, Odalarevu ,Andhra Pradesh, India.

GUIDE

DR. D S V PRASAD, M.E, Ph.D., MIE, MISTE, MIGS.,HOD, Principal, Bonam VenkataChalamayyaEngineering College, Odalarevu , Andhra Pradesh, India.

ABSTRACT

Now-a-days, the rising cost of building materials for construction purposes is a factor of great concern. The price of building materials is rising day by day as a result most of the researchers are paying much attention on the available materials which can reduce the construction cost of buildings as well as increase the strength properties of concrete by adding different materials Mainly gravel and sand are used in the preparation of conventional concrete. While the use of an agricultural by-product i.e. coconut shell as a partial replacement with coarse aggregates is expected to serve the purpose of developing housing developers in the field of building construction. Environmental impact can also reduce by making use of these waste products from agriculture. The coconut shell mainly aims to prepare light weight concrete which may be reduces the self-load of a structure and permits large precast units. The coconut shell is more resistant to acidic, salty and alkaline attack as for the climatic conditions. The main characteristic properties of concrete such as compressive strength, split tensile strength, flexural strength, impact resistance, bond strength using the mix made by replacing 5 %, 10%, 15% of coconut shell aggregates with coarse aggregates were reviewed in thispaper.

INTRODUCTION

Following a normal growth in population, the amount and type of waste materials have increased accordingly. Many of the non- decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering material. Concrete manufacturing involve consumption of ingredients like cement, aggregates, water & admixtures. Among all the ingredients, aggregates form the major parts. Twobillionofaggregateareproducedeachyearinthe UnitedStates.

Production is expected to increase to more than billion tons per year by the year similarly; the consumption of the primary aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by 2006. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operation associated with aggregates extraction and processing is the principal cause's environmental concern. In light of this in the contemporary civil engineering construction, using alternative materials in

place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material.
Apart from the above mentioned waste materials, coconut shell can also be used as aggregates in concrete due followingreasons:-
Large scale cultivation of coconut in coastal regions of India including Kerala, Andhra Pradesh, Goa, Tamil Nadu, Odisha etc.
After the kernel is consumed, the shell is thrown away here and there causing environmentalpollution.
Due to its tough made tissue, the shell is not decomposed easily and remains as solid waste for years. Hence utilizing it in a proper manner reduces environmentalproblems.
Very little percentage of shells are used in ornamental preparations, making fancy items, household utensils etc. but majority of it are discarded as waste.Helpful in cost effective housing and low risebuildingsServes as an environment-friendly constructionmaterial.

SCOPE OF THE WORK

The aim of this study is to assess the utility and efficacy of coconut shells as a coarse aggregate as an alternative to natural aggregate in concrete. Coconut shells have not been tried as aggregatein structuralconcrete.

OBJECTIVES OF THE RESEARCH

If structural LWC can be developed from coconut shells, which is locally available in abundance, it would be a milestone achievement for the local construction industries. Therefore, the main objective of this research is to determine the feasibility of using solid waste coconut shells as coarse aggregate for structural LWC. The research objectives are briefly summarized below.
To study the properties of coconut shells, compatibility of coconut shells with cement andto produce coconut shell aggregate concrete with 28 day compressive strength more than 25N/mm2.
To study the strength properties of concrete in replacement of coarse aggregate, To study the behavior of compressive, flexural and split tensile strengths. The basic properties of coconut shells such asphysical,chemical, mechanical properties, and the compatibility of coconutshells with cement were studied. Based on the standard procedures and methods followed for the production of conventional LWC, the coconut shell aggregate concrete were produced. Numerous trial mixes were conducted by varying cement content, sand, coconut shells and water- cement (w/c) ratio. The acceptable trial mixes were then identified and finally, the workability, strength, density and durability requirements for different applications of LWC were taken into consideration during the selection of the optimum coconut shell aggregate concrete mix. Also, the concrete mix was optimized for coconut shells cement ratio and w/c ratio. This optimum mix was then used throughout the entire investigation for the production of coconut shell aggregate concrete specimens. Control concrete (CC) using crushed granite stone aggregate concrete (normal weight concrete – NWC) was also produced for comparison purposes. Comparison studies between CC and coconut shell aggregate concrete were conducted only on the fresh concrete properties, compressive strength, basic and mechanical properties. The behavior of NWC, namely the structural bond, durability and temperature properties are well established. Therefore these properties were not investigated for CC in this study. Structural properties such as flexural and shear behavior of reinforced coconut shell aggregate concrete beams were studied by making prototype elements and the results are

compared with the other LWA used in concrete. Comparisons of some properties for coconut shell aggregate concrete were made using some codes of practice and other LWC. Also, tests conducted on temperature characteristics of coconut shell aggregate concrete arestudied.

COCONUT SHELL AS A ALTERNATIVE COURSEAGGREGATE

In view of thrust on energy saving and sustainable development, the use of alternative constituents of natural resources and the search of suitable alternative to conventional construction material is now a global concern. To make use of alternative aggregate in concrete which is coconut shell has never been a common practice among the people, particularly in areas where light weight concrete is required for non- load bearing walls and non-structural floors. Concrete obtained using coconut shell as a coarse aggregate satisfies the minimum requirements of concrete. Coconut shell aggregate resulted acceptable strength which is required for structural concrete. Coconut shell may present itself as a potential material in the field of construction industries. The coconut shell is compatible with cement and no need to pre-treatment for using itas coarse aggregate. Because of the smooth surface on one side of the shells concrete made with coconut shell presents better workability. Coconut shell concrete shows good impact resistance. As compared to conventional aggregate water absorbing and moisture retaining capacity of coconut shell is more. The presence of sugar in the coconut shell, does not affect the setting and strength of concrete because it is not in a free sugar form. It is found that wood based materials being hard and of organic origin, will not contaminate or leach to produce toxic substances once they are bound in concretematrix.

EXPERIMENTAL INVESTIGATION

Materials:

The constituent materials used in this investigation were procured from local sources. These materials are required by conducting various tests. Due to these results we were define what type of materials are used. We are using cement, coarse aggregate, fine aggregate, coconut shells and water.

Cement:

Ordinary Portland cement of OPC 53 grade conforming to both the requirements of IS:12269 and ASTM C642-82 type-1 was used. We are conducting different types of tests on cement, those are Normal Consistency, Intial and Final setting times, Compressive strength of cement, Specific gravity , Finenessmodulus.

Coarse Aggregate:

Normal aggregate that is crushed blue granite of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of coarse aggregate.

Fine Aggregate:

Well graded river sand passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any foreign particles prior to mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of

fine aggregate.
Coconut Shell:

The coconut palm is one of the most useful plants in the world. Coconut is grown in 92countries in the world. Global production of coconut is 51 billion nuts from an area of 12 million hectares.
Coconut shells which were already broken into two pieces were collected from local temple; air dried for five days approximately at the temperature of 25 to 30 C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 12.5mm sieve. The material passed through 12.5mm sieve was used to replace coarse aggregate with coconut shells. The material retained on 12.5mm sieve was discarded. Water absorption of the coconut shells was 8% and specific gravity at saturated surface dry condition of the material was found as 1.33.

Fig: Coconut Shells Water:
The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Water used for producing and curing concrete should be reasonably clean and free from deleterious substances such as oil, acid, alkali, salt, sugar, silt, organic matter and other elements which are detrimental to the concrete or steel. If the water is drinkable, it is considered to be suitable for concretemaking.
Tests on Materials:

Cement:

Normal Consistency ofCement
Initial and Final Setting Times ofCement
Compressive Strength ofCement
Specific Gravity ofCement
Fineness ofCement
Coarse Aggregate:

Specific Gravity ofAggregates
Bulk density in loosestate

Fineness Modulus ofAggregates

Fine Aggregate:

Finenessmodulus
Specific gravity
Bulk density in loosestate

PHYSICAL PROPERTIES OF MATERIALS	RESULTS
Cement	
Normal consistency	32%
Specific gravity	3.12
Initial setting time	52 min
Final setting time	452 min
Fineness of Cement	8%
Fineness Modulus	
Fineness modulus	2.88
Specific gravity	2.6
Bulk density in loose state	1550 kg/m^3
Coarse Aggregate	
Fineness modulus	7.22
Specific gravity	2.74
Bulk density in loose state	1654 kg/m3

Mix Proportion:

Mix design is the process of selecting an optimum proportion of cement, fine and coarse aggregates and water to produce a concrete with specified properties of workability, strength, and durability. The best mix involves a balance between economy and the required properties ofconcrete.
In order to investigate properties of coconut shells concretes, five mixes were employed. Control mix (M1) that is, without coconut shells was made. Coarse aggregate was then replaced with coconut shells in 5% (M2), 10% (M3), 15%(M4) percentages to study effect of CS replacement.
Water Cement Ratio (w/c):

It is difficult to specify the optimal w/c ratio for all kinds of cement composite. Hence, it is necessary to optimize the coconut shells aggregate - cement ratio and w/c ratio. It is seen that with the increase of w/c ratio, the strength of coconut shell aggregate concrete reduced. Therefore w/c ratio was considered as 0.45.
Mix Design for M25 Grade Concrete:

Grade of concrete: **M25**

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

Method used : IS code method

Fck = fck + t s = 33.25 (t =1.65, s =5) Water cement ratio: **0.45**
Compaction factor: **0.85**

Maximum size of aggregate: **20 mm** Specific gravity of cement **Sc : 3.12** Specific gravity of fine aggregate **Sfa : 2.6**
Specific gravity of coarse aggregate **Sca : 2.74**

Cement content **: 138 kg / m3**

Cement content = 437

Fine aggregate content = 599.04 Coarse aggregate content = 1171.52

W	C	FA	CA
197	437	599.04	1171.52
0.45	1	1.37	2.68

CASTING:
For casting the test specimens, standard size of 150 × 150 × 150mm cubes and cylinders 150 x 150, 150 x 100 mm made with cast iron, metal moulds are used to cast the test specimens. The moulds have been cleaned to remove the dust particles from the mould and mineral oil is applied on all sides of the mould, before concrete is poured into the mould. Thoroughly mixed concrete is filled into the mould and vibrated by pin vibrator. Excess concrete was removed with travel and top surface is finished level andsmooth.

Figure: Casting of concrete cubes

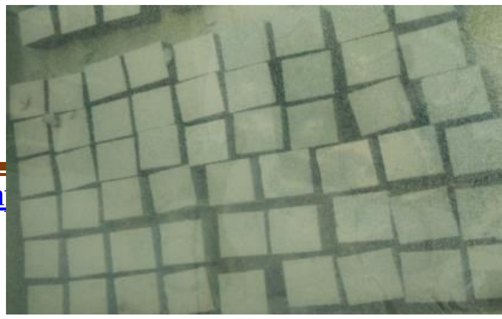


Fig:Curing of concrete cubes

Test program:

The main objective of the present investigation was to study the performance of coconut shells concretes in terms of strength. The specimens were tested for compression and split tensile strengths and flexural strengths at 7 , 14 and 28 days.

Compressive Strength:

The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7 , 14 and 28 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined asfollows

Compressive strength = Crushing Load (kN) /Effective Area (mm2)

Split Tensile Strength:

Split tensile strength test was conducted in accordance with ASTM C496. Cylinders of 100 x200 mm size were used for this test, the test specimens were placed between two platens with two pieces of 3 mm thick and approximately 25 mm wide plywood strips on the top and bottom of the specimens. The split tensile strength was conducted on the same machine on

which the compressive strength test was performed. The specimens were tested for 7 ,14 and 28days.

Flexural Strength:

Flexural tests are generally used to determine the flexural modulus or flexural strength of a material. A flexural test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to top of the material through either one or two points of contact(upper loading span) until the sample fails. The maximum recorded force is flexural strength of that particular sample.

TEST RESULTS:

Compressive strength test results:

S.No	**Grade of concrete**	7days strength(N/mm^2)	14 days strength(N/mm^2)	28days strength(N/mm^2)
1.	CONVENTIONAL CONCRETE	24	28	36
2.	5% CS	25	29	37
3.	10% CS	23	27	34
4.	15%CS	21	25	30

FLEXURAL TEST:

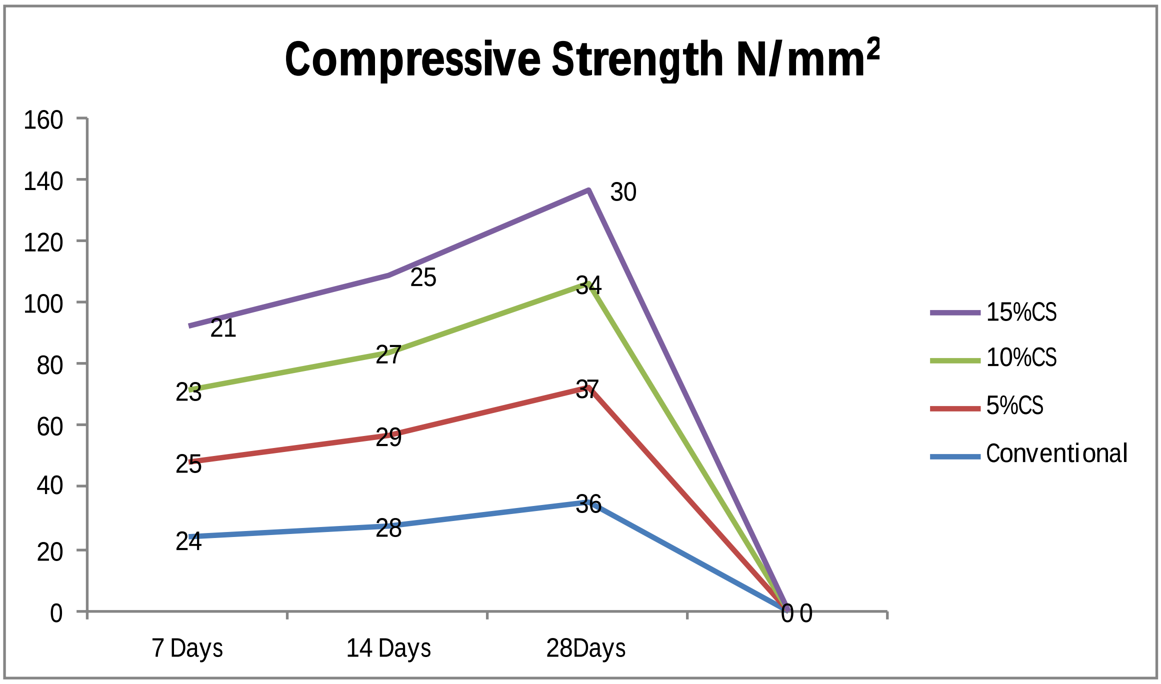
S.No	**Grade of concrete**	**Flexural strength Of 7 days (Mpa)**	**Flexural Strength of 14 days (Mpa)**	**Flexural Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.38	3.01	3.62
2.	5% CS	2.52	3.17	3.89
3.	10% CS	2.95	3.83	5.23
4.	15%CS	3.36	4.82	5.12

TENSILE TEST:

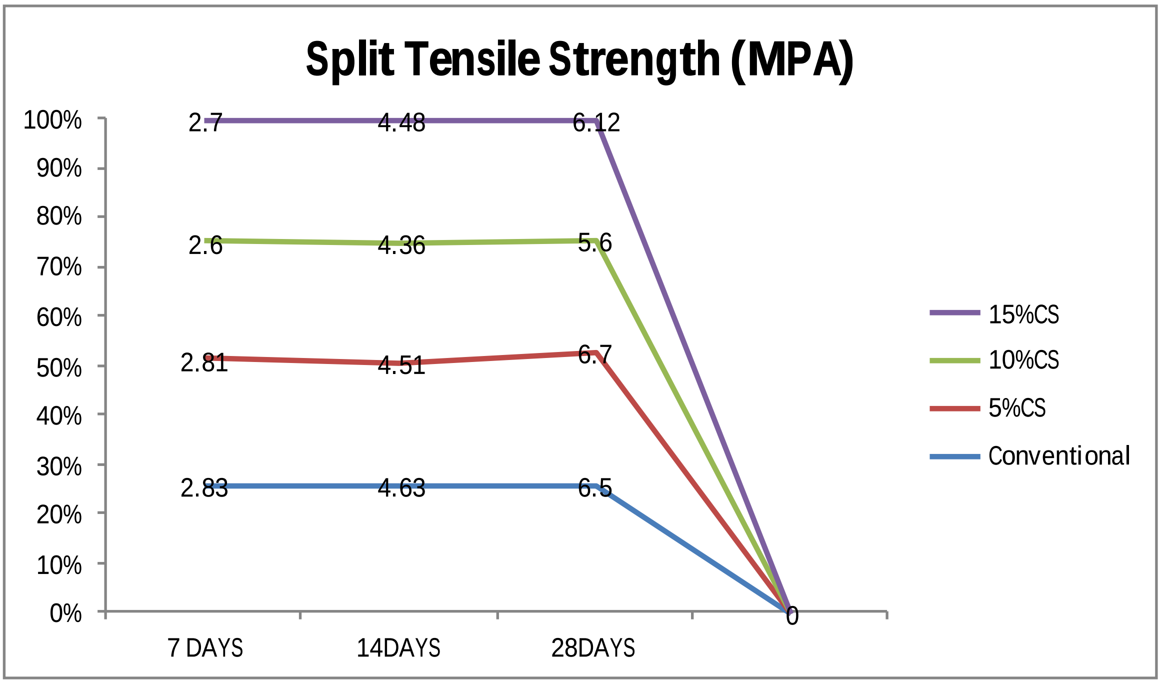
S.No	**Grade of concrete**	**Split- tensile strength Of 7 days (Mpa)**	**Split-tensile strength Of 14 days (Mpa)**	**Split- tensile Strength of 28 days (Mpa)**
1.	CONVENTIONAL CONCRETE	2.83	4.63	6.5
2.	5% CS	2.81	4.51	6.7
3.	10% CS	2.6	4.36	5.6
4.	15%CS	2.7	4.48	6.12

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 07 Issue 02
February 2020

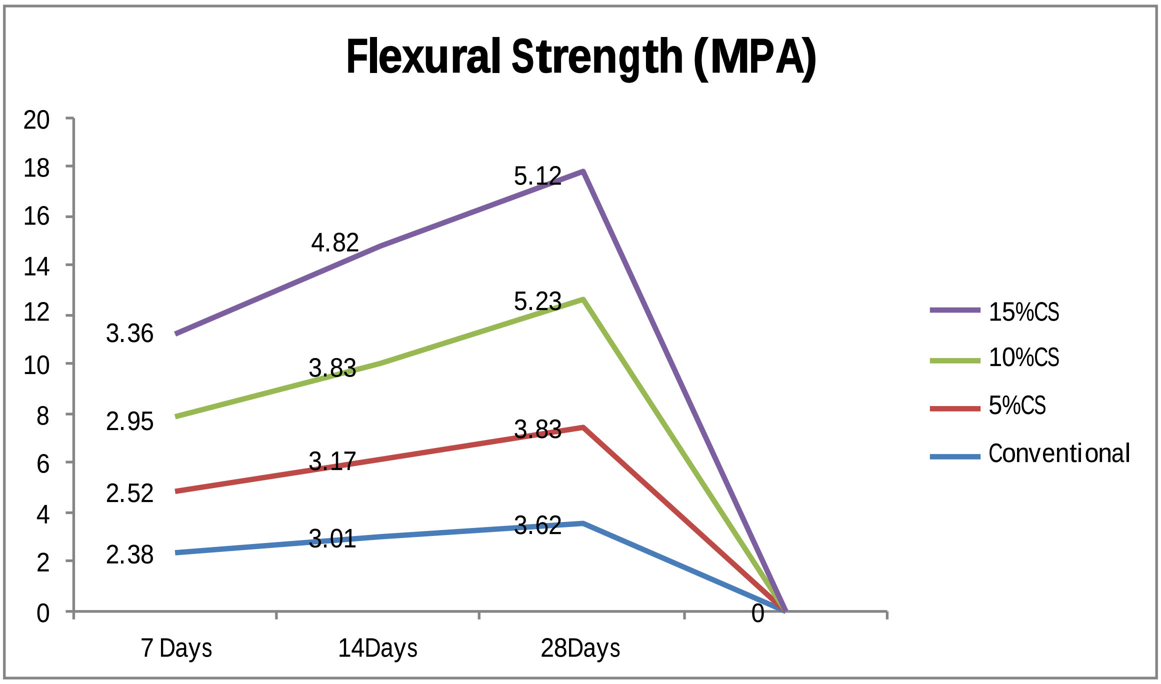
GRAPHS:
Compressive strength:



Split Tensile Strength:



Flexural Strength:



CONCLUSIONS:

The compressive strength for 5 percentages of coconut shell aggregates is 37 N/mm^{2}at 28 days. The compressive strength decreases as the percentage of coconut shell is increased. Therefore coconut shell concrete can be used where light weight concrete isused.

The maximum flexural strength is obtained by replacing the coarse aggregates with 10%coconut shell are5.23Mpa at 28days.

The maximum split tensile strength is obtained at 5% replacement of coconut shell aggregates is 6.7Mpa for 28 days upon increasing the coconut shell percentage the strength decreases. Therefore the optimum strength is taken as 5 % replacement of coconut shell with aggregates.

REFERENCES:

1. Olanipekun,E.A.,Olusola,K.O. and Ata O, “A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates”. Building and Environment 41: pp: 297-301,2006.
2. TukimanSitiaminahBt and Mohd Bin Sabarudin, “Investigation of the combination of coconut shell and grained palm kernel to replace aggregate in concrete-A technical Review”. National Conference on Postgraduate Research (NCON-PGR)-2009; pp: 49-57,2009.
3. YerramalaAmarnath and C Ramachandradu, “Propertiesofconcrete with coconut shell as aggregate replacement”. International Journal of Engineering Inventions; Volume 1, Issue 6 (October 2012) pp; 21-31, 2012.