EXPERIMENTAL INVESTIGATION ON REPLACEMENT OF FINE AGRREGATE BY AGRI WASTE (COCONUT SHELL & RICE HUSK ASH)

Mr. M. Sudarsanan

Assistant Professor, JCT College of Engineering and Technology, Coimbatore.

Swaroop K Raveendran

Student, JCT College of Engineering and Technology, Coimbatore.

Abstract -Concrete is the most undisputable and indispensable material being used in infrastructure development throughout the world.To avoid environmental degradation the consumption of natural resources should be reduced by using alternate sources.Due to industrialization enormous quantity of waste is produced as by product, which can be effectively used as an alternate for the natural resources.Rice husk ash and coconut shell is one of the byproduct obtained from agricultural waste which can be used as the replacement of fine aggregate in concrete thus by reducing the quantity of river sand. In this experiment, the behaviour of concrete using rice husk ash and coconut shell are determining. The mix design is done for M20 grade concrete as per Indian Standard. The different percentage of natural fiber (i.e.) rice husk ash and cocnut shell of the range 5% to 20% by weight of cement were used in the investigation were used. The concrete specimen with different percentages will cast, cure and test for 7 and 28 days. The test result will compare with control specimen.

Keywords : Concrete, rice husk ash, coconut shell powder, compressive strength, flexural strength, split tensile strength.

I. INTRODUCTION

These days apart from steel, concrete is the most and widely used as structural material in the construction field. Concrete defined as a composite materials made up of composed granular materials (the aggregate and filler) embedded in a hard matrix of materials (cement or binder) and water that fills the space between the aggregate particles and glues them together. There are many type of concrete with different materials used and mix design. Alone with the addition of agri wastes plays a predominant role in achieving better strength, durability, water tightness, abrasion resistance, volume stability and resistance to freezing and thawing.

Rice husk is an agricultural residue which accounts for 20% of the 649.7 million tons of rice produced annually worldwide. The produced partially burnt husk from the milling plants when used as a fuel also contributes to pollution and efforts are being made to overcome this environmental issue by utilizing this material as a supplementary cementing material. The chemical composition of rice husk is found to vary from one sample to another due to the differences in the type of paddy, crop year, climate and geographical conditions.

The husk was collected from paddy field in Kuala Selangor, Malaysia, it was then burned in the laboratory by using a ferro-cement furnace. This furnace can hold up to 60 kg of rice husks; it has three small openings through which fire is ignited They too allow ventilation. A fire source was maintained under the furnace for around 10 minutes, after which the husk slowly burned for more than one day. The ash was left inside the furnace to cool down before it was collected.

Coconut shell particles are used as reinforcing material for investigation. Shell particles of size between 200-800μm are prepared in grinding machine. Coconut shell filler are potential candidates for the development of new composites because of their high strength and modulus properties. A approximate value of coconut shell density is 1.60 g/cm^3

II. OBJECTIVE

The main objective of this project are :

- ✓ The objective of this investigation is to determine the behavior of concrete with agri waste.
- ✓ To conduct compressive strength, flexural strength and split tensile test for concrete with agricultural waste at various percentages are using.
- ✓ To compare the result with control specimen and individual concrete based on the strength and durability of the concrete.

LITERATURE REVIEW

They investigated the use of rice husk ash and coconut shell and tho study the compressive strength and compare it with control specimen. The cubes were weighted at 7 and 28 days firm the date of demoulding and their behavior was plotted in graph against number of days of curing.

1.Sourav Ghosal, S. Moulik International Journal of Engineering Research ISSN:23196890)(online),2347-5013(print) Volume No.4, Issue No.9, **"Use of Rice Husk Ash as Partial Replacement with Cement In Concrete- A Review",**

This paper studies that the rice husk as a partial replacement with the conventional fine aggregates is expected to serve the purpose of encouraging housing developers in building construction. .Ash from rice is obtained as a result of combustion of rice husk at suitable temperature. The main objective is therefore to encourage the use of these 'seemingly' waste products as construction materials in low cost housing.The various basic properties of rice husk concrete are reviewed in this paper.

Mohamed BarveenInternational Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 5, "**STUDY ON THE EFFECT OF RICE HUSK ASH IN COCONUT SHELL CONCRETE**"

This paper deals with OPC was replaced by RHA by 0%, 2%, 4%, 6%,8%, 10% and 12%. Workability, density of concrete, mechanical properties such as compressive strength, splitting tensile strength, flexural strength, impact resistance and modulus of elasticity were examined and compared with the standard values. Two concrete mixes were selected one for conventional concrete (CC) and another for coconut shell concrete (CSC). The compressive strength increases with increase in RHA replacement and gives good results up to 10% replacement of RHA. This study proves that replacement of RHA at 10% in coconut shell concrete enhances the workability and mechanical properties of both conventional concrete and coconut shell concrete.

R Gopinath , T Ajithkumar , M Nithin , V Sanjay Srikanth , P Sivakumar, International Journal of Scientific & Engineering Research Volume 9, Issue 4, April-2018, "**EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF COARSE AGGREGATE BY COCONUT SHELL AND ORDINARY PORTLAND CEMENT BY RICE HUSK ASH**".

This paper studies that the percentage of replacement are 0%, 18%, 20%, 22%, 24% with coconut shell and 0%, 5%, 8%, 10%, 12% with rice husk ash. The characteristic properties of concrete such as compressive strength, split tensile strength using the mix made by partial replacement of coarse aggregate with crushed coconut shell aggregate and ordinary Portland cement with rice husk ash were reviewed in the present work. The results show that high strength is attained at replacement of 18% with coconut shell and 8% with rice husk ash.

Shahiron Shahidan1,a, Alif Syazani Leman2 , Mohamad Syamir Senin3 , Nurul Izzati Raihan Ramzi Hannan4, MATEC Web of Conferences 87 , 01005 (2017), "**Suitability of Coconut Shell Concrete for Precast Cool Wall Panel-A Review**"

This paper studies that The aim is to produce concrete with improved properties at a lower cost and to maintain environmental sustainability. In this review paper, the suitability of coconut shell for concrete cool wall panels will be the main focus. Coconut shells can be used as aggregates in concrete. The characteristic properties of coconut shell concrete such as workability, bulk density, compressive strength, flexural tensile, water absorption and thermal performance were reviewed in this paper. This paper attempts to answer whether coconut shell is suitable to be used in concrete to produce a concrete cool wall panel in order to reduce heat transfer inside a building

Shaikh Tanzeem et.al; International Journal of Advance Research, Ideas and Innovations in Technology, (Volume 4, Issue 3), "**Replacement of fine aggregate with plastic in concrete**"

This paper studies that There are different types of plastic which are classified on the basis of the physical property. As the plastic waste is nondegradable, it must be recycled or reused. The objective of the study is to study the behavior of the concrete which is made of the recycled plastic materials along with the study of the some of the physical properties that are related. In this study, M40 cement concrete is considered in which the recycled plastic waste is used as the replacement of fine aggregate in the concrete. Concrete cubes were cast taking 10%, 20%, 30 %, 40% & 50% of plastic as partial replacement of fine aggregate and tested for 7 & 28 days of compressive strength of concrete.

III. METHODS AND METHODOLOGY

CEMENT

Cement is a binding materials used in the preparation of concrete. It binds the coarse aggregate and fine aggregate with the help of water, to a monolithic matter and also it fills the voids in the concrete. There are two requirements for any cement in the concrete mix design. That is compressive strength development with time attainment of appropriate rheological characteristics, type and production of cement. It occurs when the cement has hardened to the point at which it can sustain some load. The specimen has to taken out of the mould are subjected to the compression of determining the strength.

OPC 53 grade sample was tested to obtain the following characteristics as per IS 12269 – 1987

1. Specific Gravity
2. Standard Consistency
3. Initial Setting Time
4. Final Setting Time
5. Fineness

PROPERTIES OF CEMENT

- It provides strength to masonry
- It is stiffness or hardens easily
- It was posses good plasticity
- An excellent building resistance materials
- Easily workable
- Good moisture resistance

FINE AGGREGATE

The fine aggregate used in manufacturing of concrete should be free from debris, fungi and chemical attack. It plays a vital role in concrete, so it should durable, angular and sharp edges then only it and gives a rich mix concrete and workability.

PROPERTIES OF FINE AGGREGATE

- It should be clean and coarse
- It should be free any organic or vegetable matter
- It is usually 3 to 4 % of clay in permitted

- It is chemically alert and well graded
- The finess modulus of sand should between 2 and 3

COARSE AGGREGATE

Aggregates are the important constituents in concrete. They give body to the concrete, reduces shrinkage and effect economy. Earlier aggregates were considered as chemically insert materials but now its as to been recogonized that some of aggregates are chemically active and also that certain aggregate exhibit chemical bon at interface of aggregate and paste. That more aggregate occupy 70-80 percentage of concrete: their impact on various characteristics and properties of concrete is undoubtedly.

PROPERTIES OF COARSE AGGREGATE

- Important parameter of coarse aggregate are shape, texture, grading, cleanliness and nominal maximum size
- Becomes increasingly important as target strength increases, particularly
  In the case of high strength lightweight aggregate concrete.
- Durability properties notwithstanding, important coarse aggregate properties to consider includes strength, stiffness, bonding potential, and absorption.
- Have found that using coarse aggregates with greater stiffness can increase the elastic modulus while at the same time decrease the strength capacity.
- Angular coarse aggregate provide mechanical bond and are generally more suitable for use in high strength concrete that smooth textured aggregates.

WATER

Water is an important in gradient of concrete as it activity participates in the chemical reactions with cement. The strength of cement concrete mainly from binding action of the hydradation of cement.

It get the requirement of water should be reduced that required chemical reaction of unhydrated cement excess water would end up in only formation undesirable voids (or) capillaries in the hardened cement paste in concrete.

It is important to have the compatible between the given cement and the chemical materials admixtures along with the water used for mixing. It is generally stated in the concrete codes and also in the literature that the water fit for making concrete. This may not to true always. BE suitable for drinking, as they good for cement concrete as the sugar would adversely affect the hydration process.

RICE HUSK ASH

Rice husk is an agricultural residue which accounts for 20%

of the 649.7 million tons of rice produced annually worldwide. The produced partially burnt husk from the milling plants when used as a fuel also contributes to pollution and efforts are being made to overcome this environmental issue by utilizing this material as a supplementary cementing material. The chemical composition of rice husk is found to vary from one sample to another due to the differences in the type of paddy, crop year, climate and geographical conditions. The husk was collected from paddy field in Kuala Selangor, Malaysia, it was then burned in the laboratory by using a ferro-cement furnace. This furnace can hold up to 60 kg of rice husks; it has three small openings through which fire is ignited They too allow ventilation. A fire source was maintained under the furnace for around 10 minutes, after which the husks slowly burned for more than one day. The ash was left inside the furnace to cool down before it was collected.

COCONUT SHELL

Coconut shell particles are used as reinforcing material for investigation. Shell particles of size between 200-800μm are prepared in grinding machine. Coconut shell filler are potential candidates for the development of new composites because of their high strength and modulus properties. A approximate value of coconut shell density is 1.60 g/cm3 .

RESULT AND DISCUSSION

1. COMPRESSIVE STRENGTH

Compressive strength test out is completed at particular ages about cubes. The specimen of standard dice of (150 mm

back button 150 logistik x one hundred and fifty mm) utilized to determine the compressive strength of concrete. Dice specimen of size 100mm x 100mm x 100mm can also be used. The fabric was assessed and the supplies were blended manually. The concrete was filled in distinct layers inside the mould and layer was compacted with the aid of tamping fishing rod. The example of beauty was taken out of mould following 24 hours, treated in tidy water to get 7 and 28 days and nights. After 1 week and twenty eight days of solving, the individuals are applied for,

wiped dry out and then analyzed for compressive strength according to Indian Common in compression testing equipment. The dice is placed so that the load works perpendicular for the compacted aspect. Load can be applied before the failure in the specimen. The supreme load is certainly noted

Compressive strength of the specimen is calculated using the formula,

fck = P/A

Where, fck = Compressive strength (N/mm²)
P = Ultimate load (N)
A = Loaded area (150mm x 150mm)

2. FLEXURAL STRENGTH

The example of standard crystal of 100 x 100 x 500mm was utilized to decide the flexural quality of cement. Three examples were tried for 7 and 28 days. The material was gauged and the materials were blended physically. The solid was filled in various layers in the shape and each layer was compacted with the assistance of packing pole. The example was expelled from form following 24 hours, relieved in clean water for 7 and 28 days .After 7 days and 28 days of restoring, the examples are taken out, cleaned dry and afterward tried for flexural quality according to Indian Standard in general testing machine. Flexural quality is discovered utilizing focus point stacking framework. The example is situated in the gear so that the weight is put on the best surface as cast inside the shape. The hub of example is typically cautiously agreed with the hub of the starting gadget. Burden is connected until the disappointment of the example. A definitive burden and breaking load is noted. The flexural quality of the example is communicated as modulus of burst, fb and is determined utilizing the equation

,fb = (N/mm²)

Where, P = Ultimate load (N)
L = Centre to centre distance between the supports (400mm)
b = Breadth of the specimen (100 mm)
d = Depth of the specimen (100 mm)

IV. RESULT AND DISCUSSION

1. COMPRESSIVE STRENGTH

Compressive strength test out is completed at particular ages about cubes. The specimen of standard dice of (150 mm back button 150 logistik x one hundred and fifty mm) utilized to determine the compressive strength of concrete. Dice specimen of size 100mm x 100mm x 100mm can also be used. The fabric was assessed and the supplies were blended manually. The concrete was filled in distinct layers inside the mould and layer was compacted with the aid of tamping fishing rod. The example of beauty was taken out of mould following 24 hours, treated in tidy water to get 7 and 28 days and nights. After 1 week and twenty eight days of solving, the individuals are applied for, wiped dry out and then analyzed for compressive strength according to Indian Common in compression testing equipment. The dice is placed so that the load works perpendicular for the compacted aspect. Load can be applied before the failure in the specimen. The supreme load is certainly noted

Compressive strength of the specimen is calculated using the formula,

fck = P/A

Where, fck = Compressive strength (N/mm²)
P = Ultimate load (N)
A = Loaded area (150mm x 150mm)

2. FLEXURAL STRENGTH

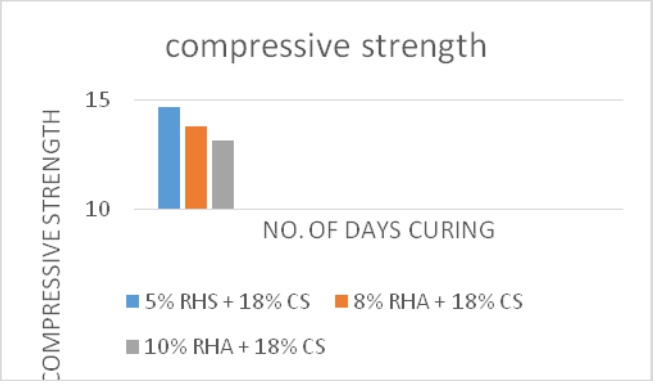
The example of standard crystal of 100 x 100 x 500mm was utilized to decide the flexural quality of cement. Three examples were tried for 7 and 28 days. The material was gauged and the materials were blended physically. The solid was filled in various layers in the shape and each layer was compacted with the assistance of packing pole. The example was expelled from form following 24 hours, relieved in clean water for 7 and 28 days .After 7 days and 28 days of restoring, the examples are taken out, cleaned dry and afterward tried for flexural quality according to Indian Standard in general testing machine. Flexural quality is discovered utilizing focus point stacking framework. The example is situated in the gear so that the weight is put on the best surface as cast inside the shape. The hub of example is typically cautiously agreed with the hub of the starting gadget. Burden is connected until the disappointment of the example. A definitive burden and breaking load is noted. The flexural quality of the example is communicated as modulus of burst, fb and is determined utilizing the equation

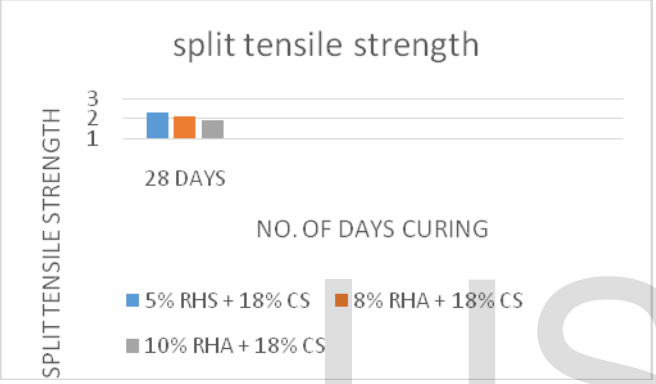
,fb = (N/mm²)

Where, P = Ultimate load (N)
L = Centre to centre distance between the supports (400mm)
b = Breadth of the specimen (100 mm)
d = Depth of the specimen (100 mm)

Replacement of rice husk ash + cocnut shell	Specimen no.	Compressive strength in N/mm2 for 28 days	Average Compressive strength
5% RHA + 18% CS	1	14.58	14.64
	2	14.7	
8% RHA + 18% CS	1	13.83	13.79
	2	13.75	
10% RHS + 18% CS	1	13.08	13.1
	2	**13.12**	

Replacement of rice husk ash + cocnut shell	Specimen no.	Split tensile strength in N/mm2 for 28 days	Average split tensile strength
5% RHA + 18% CS	1	2.28	2.285
	2	2.29	
8% RHA + 18% CS	1	2.14	2.125
	2	2.11	
10% RHS + 18% CS	1	1.95	1.92
	2	1.91	





CONCLUSION

- The rice husk ash used as partial replacement of cement gives better results at 5 – 8 % replacement of RHA. The maximum replacement of RHA shall not be more than 10%.
- The test result obtained from replacing coconut shell for coarse aggregate shows that it is better when 18 % coconut shell is used, the maximum replacement shall not be above 20%.

REFFERENCE

- Sourav Ghosal, S. Moulik International Journal of Engineering Research ISSN:2319-6890)(online),2347-5013(print) Volume No.4, Issue No.9, “Use of Rice Husk Ash as Partial Replacement with Cement In Concrete- A Review”
- M. Mohamed BarveenInternational Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 5, “STUDY ON THE EFFECT OF RICE HUSK ASH IN COCONUT SHELL CONCRETE”
- R Gopinath1 , T Ajithkumar2 , M Nithin3 , V Sanjay Srikanth4 , P Sivakumar5, International Journal of Scientific & Engineering Research Volume 9, Issue 4, April-2018, “EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF COARSE AGGREGATE BY COCONUT SHELL AND ORDINARY PORTLAND CEMENT BY RICE HUSK ASH”.
- Shahiron Shahidan1,a, Alif Syazani Leman2 , Mohamad Syamir Senin3 , Nurul Izzati Raihan Ramzi Hannan4, MATEC Web of Conferences 87 , 01005 (2017), “Suitability of Coconut Shell Concrete for Precast Cool Wall Panel-A Review”
- Shaikh Tanzeem et.al; International Journal of Advance Research, Ideas and Innovations in Technology, (Volume 4, Issue 3), “Replacement of fine aggregate with plastic in concrete”
- IS : 383 – 1970, specification for coarse aggregate from natural sources for concrete.
- IS : 383 – 1970, specification for fine aggregate from natural sources for concrete.
- IS : 10262 – 1980, recommended guidelines for concrete mix design.
- IS : 516 – 1959, compressive strength of concrete.
- IS : 516 – 1959, flexural strength of concrete.
- IS : 5816 – 1999, split tensile strength of concrete.
- IS : 10262 – 2009, for mix design.