International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 11 | Nov 2020 www.irjet.net p-ISSN: 2395-0072

"Effect on Mechanical Properties of Concrete with Partial Replacement of Various Coconut Constituents"

Chandradeo Kumar[1], Siddharth Pastariya[2]

[1]M.Tech Scholar, Department of Civil Engineering, Sri Aurobindo Institute of Technology Indore M.P
[2]Assistant Professor, Department of Civil Engineering, Sri Aurobindo Institute of Technology Indore M.P

Abstract—*Concrete cubes were produced using various replacement levels of 0%, 5%, 10%, 15% and 20% of OPC with CSA. Also in the concern of rising the cost of construction materials to reduce the amount of coarse aggregate in concrete and making the concrete light weight, supplementary material are used. Coconut shell is most popular material used in the concrete which is replaced by 0%, 5%, 10%, 15%, and 20% by the weight of coarse aggregate and different properties of coconut shell aggregate concrete is examined. Reinforcement of concrete is necessary to enhance its engineering properties. Coconut fibres were used as they are freely available in large quantities. The addition of coconut fibres improved the Split tensile strength of concrete, they also formed good bonding in the concrete. For this purpose optimum fibre content to be 4% (by weight of cement) is taken in our work. Water binder ratio is taken 0.42 for M-20 grade of concrete. A total of 30 cubes, 20 cylinders and 30 cubes with 16mm bar were produced and cured by immersing them in water for 7 and 28 days respectively. And these specimens are tested for Compressive Strength, Flexural Strength, Split Tensile Strength, Bond Strength and also the density of concrete. The results show that the maximum increase in compressive strength & bond strength of concrete occurred when 10% cement and 10% coarse aggregate replacement was done with coconut shell ash and coconut shell. Flexural strength is maximum when 0% cement and 15% coarse aggregate & 15% cement and 5% coarse aggregate replacement was done with coconut shell ash and coconut shell with addition of 4% coconut fibre by weight of cement. Split tensile strength is maximum when 0% cement and 20% coarse aggregate & 15% cement and 5% coarse aggregate replacement was done with coconut shell ash and coconut shell with addition of 4% coconut fibre by weight of cement. Also the concrete is considered as light weight concrete when 0% cement and 20% coarse aggregate & 5% cement and 15% coarse aggregate replacement was done with coconut shell ash and coconut shell, as density of these two types of concrete mixes is less than 2000 kg/m3*

Keywords; CSA, water cement ratio, compressive strength, flexural strength, tensile strength, Light Weight Concrete

1. INTRODUCTION

Many of the non-decaying waste materials can remain within the setting for hundreds, maybe thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributive to the environmental issues. However, the environmental impact are often reduced by making a lot of property use of this waste. This is often referred to as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the well-liked choice of waste disposal. there were several experimental work conducted to enhance the properties of the concrete by swing new materials, whether or not it's natural materials or recycle materials or synthetic materials within the concrete combine. Concrete is a synthetic material similar in look and properties to some natural lime stone rock. it's a person created composite, the major constituent being natural aggregate like gravel, or gravel, sand and fine particles of cement powder all mixed with water. The concrete as time goes on through a method of association of the cement paste, producing a needed strength to face up to the load. The use of coconut shell in concrete has never been a usual apply among the common voters, notably in areas wherever lightweight weight concrete is needed for non-load bearing walls, non-structural floors, and strip footings. The chemical composition of the coconut shell is similar to wood. Coconut is grown in additional than ninety three countries. Concrete is defined as manmade composite material during which major constituents is binding medium and aggregate particles. it's thought of as a really sturdy material with very little or no maintenance. The concrete is especially designed on the premise of compressive strength at identical time concrete is weak in durability and little resistance to cracking, and a lot of drying shrinkage ,less abrasion and erosion resistance. For special sort of constructions like high rise buildings, long span bridges, deep underground structures the concrete ought

to possess high performance in terms of durability and strength. therefore the inherent properties of traditional concrete ought to be increased to the requirement by the addition of admixtures or suitable ingredients. Production of concrete involves the varied steps like volume or weigh batching the materials of concrete like cement, coarse aggregate and fine combination and water and also the mixing it in a very correct proportion consistent with the mix style as per IS codes. The coarse aggregate shouldn't contain any flakiness or elongation and also the fine combination should be free from trash and any kind of impurities, water used for commixture of concrete should be portable water. Concrete is that the most consumed material once water.

2. MATERIAL USED

2.1 Cement: Ordinary Portland cement (OPC) 43 grade is used in this research work.

.

2.2 Sand: Sand is available near Narmada River. This sand is used for the above research work.

2.3 Natural aggregate: 20 mm natural coarse aggregate is used having a specific gravity of 2.72..

2.4 Coconut Shell: The high cost of conventional construction material affects economy of structure. With increasing concern over the excessive exploitation of natural aggregates, artificial light-weight mixture produced from environmental waste may be a viable new supply of structural mixture material. The uses of structural grade light-weight concrete reduce considerably the self-load of a structure and permit larger precast units to be handled.

2.5 Coconut Fiber: Use of coconut fiber (Coir) should be valued over Steel for the following reasons like low value, recyclability, no corrosiveness, low thermal conduction (natural cooling), high strength and low weight magnitude relation. In earthquake prone areas wherever frequent harm to infrastructure takes place, the use of Natural fibers like fiber instead of steel will prove advantageous.

2.6 Coconut Shell Ash: The Coconut Shell ash is used for the partial replacement of cement. Further, use of coconut shell ash as a value else material as within the case of binary mingling cement concrete, reduces the consumption of cement. Reduction of cement usage can reduce the production of cement that in turn cut the carbon dioxide emissions

3. EXPERIMENTAL WORK AND TEST

3.1 Mix Design for M-20 Grade: The proportion of M-20 grade concrete is calculated as per IS 10262-2009 & IS 456-2000 is 1 : 1.82 : 3.12 Water binder ratio is taken as 0.42.

3.2 Compressive Strength Test: The mould is prepared for cubes used in the compression test having a size of 0.15mX0.15mX0.15m. After preparing cubes rest on the compression testing machine and load is applied. After applying load the value noted from the dial gauge. Compressive strength determine at 7 & 28 days.

3.3 Flexural Strength Test: The mould is prepared for beams used in the bending test having a size of 0.10mX0.10mX0.50m. After preparing beams rest on the flexural testing machine and load is applied. After applying load the value noted from the dial gauge. Bending strength determine at 7 & 28 days

3.4 Split Tensile Strength: The mould is prepared for cylinder used in the tensile test having a size of 0.15m diameter and 0.30m height. After preparing cylinder rest on the compression testing machine and load is applied. After applying load the value noted from the dial gauge. Tensile strength determine at 7 & 28 days

4. TEST RESULTS

4.1 Compressive Strength; The below table shows the compressive strength for different percentage of coconut shell, coconut shell ash, coconut fiber

Table 1: Compressive Strength Result

Mix Design	Combination	7 days Compressive Strength	28 days Compressive Strength
Mix-01	C+S+NCA(80%)+ CF(4%)+CS(20%)	16.55	26.49
Mix-02	C(95%)+CSA(5%) +S+NCA(85%)+C S(1 5%)+ CF(4%)	17.37	27.36
Mix-03	C(90%)+CSA(10 %)+S+NCA(90%) +CS(10%)+ CF(4%)	18.86	30.61
Mix-04	C(85%)+CSA(15 %)+S+NCA(95%)	16.90	28.67

	+CS(5%)+ CF (4%)		
Mix-05	C80%)+CSA(20%)+S+NCA+ CF (4%)	16.27	25.16

4.2 Flexural Strength The below table shows the Bending strength for different percentage of coconut shell, coconut shell ash, coconut fiber.

Table 2: Flexural Strength Result

Mix Design	Combination	7 days Flexural Strength	28 days Flexural Strength
Mix-01	C+S+NCA(80%)+ CF(4%)+CS(20%)	3.8	5.34
Mix-02	C(95%)+CSA(5%) +S+NCA(85%)+C S(1 5%)+ CF(4%)	4.38	5.96
Mix-03	C(90%)+CSA(10 %)+S+NCA(90%) +CS(10%)+ CF(4%)	4.56	6.54
Mix-04	C(85%)+CSA(15 %)+S+NCA(95%) +CS(5%)+ CF (4%)	4.28	5.90
Mix-05	C80%)+CSA(20%)+S+NCA+ CF (4%)	4.21	5.56

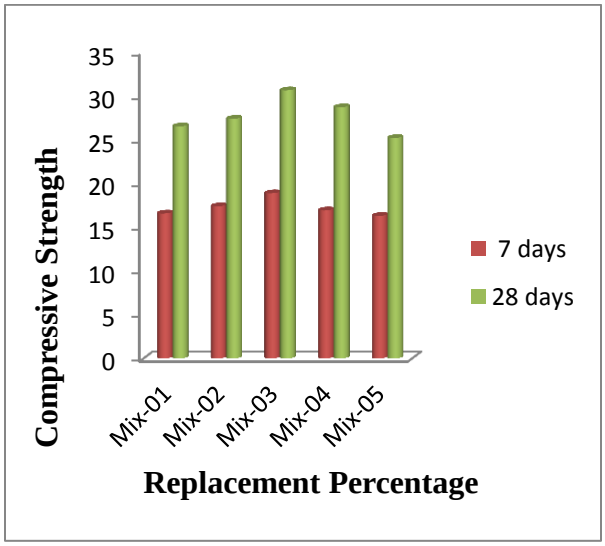
4.3 Split Tensile Strength The below table shows the tensile strength for different percentage of coconut shell, coconut shell ash, coconut fiber.

Table 3: Tensile Strength Result

Mix Design	% Silica fume	7 days Split Tensile Strength	28 days Split Tensile Strength
Mix-01	C+S+NCA(80%)+ CF(4%)+CS(20%)	2.74	4.01
Mix-02	C(95%)+CSA(5%) +S+NCA(85%)+C S(1 5%)+ CF(4%)	2.56	3.71
Mix-03	C(90%)+CSA(10 %)+S+NCA(90%) +CS(10%)+ CF(4%)	2.35	3.38
Mix-04	C(85%)+CSA(15 %)+S+NCA(95%) +CS(5%)+ CF (4%)	2.92	4.01
Mix-05	C80%)+CSA(20%)+S+NCA+ CF (4%)	2.70	3.74

5. DISCUSSION ON TEST RESULTS

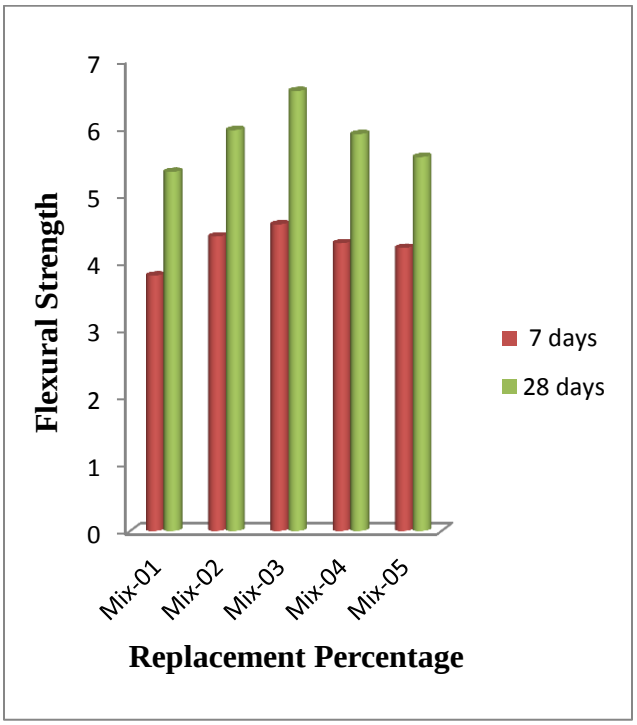
5.1 Compressive Strength Test: As shown in the graph (7 days strength), when cement is partially replaced 10% by CSA, compressive strength is increased by 16.31%. Afterwards when addition of % of CSA is replaced, strength starts decreasing, a minimum strength is achieved.28 days strength in graph show an increment of 15.55% of strength of 10% replacement of CSA as compared with conventional concrete. Again strength is decreased when addition of percentage of CSA increase



Graph: 1. Compressive Strength in N/mm2

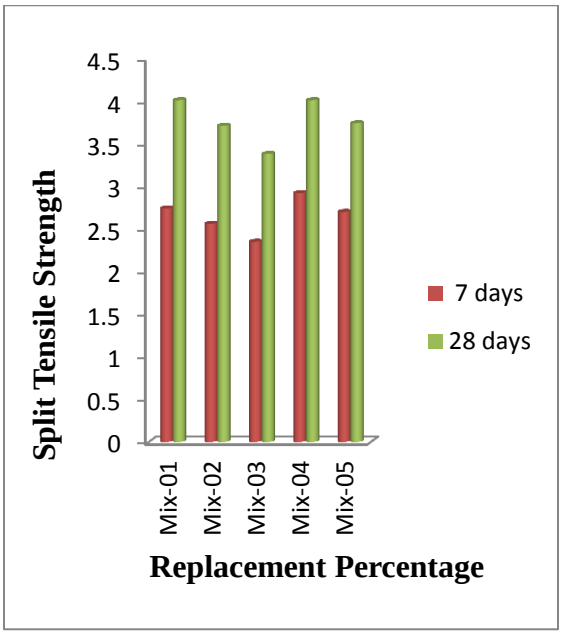
5.2 Flexural Strength: As shown in the graph (7 days strength), when cement is partially replaced 10% by CSA, Flexural strength is increased by 16.57%. Afterwards when addition of % of CSA is replaced, strength starts decreasing, a minimum strength is achieved. 28 days strength in graph show an increment of 25.09% of strength of 10% replacement of CSA as compared with

conventional concrete. Again strength is decreased when addition of percentage of CSA increase



Graph: 2 Flexural Strength in N/mm2

5.3 Split Tensile Strength: As shown in the graph (7 days strength), when cement is partially replaced 15% by CSA i.e., Split Tensile strength is increased by 23%. Afterwards when % of CSA is increased the strength starts decreasing 28 days strength in graph shows and increment of 29% of strength of 15% replacement of CSA as compared with conventional concrete. Again strength is decreased when % of CSA is increased.



Graph 3: Split Tensile Strength in N/mm2

6. CONCLUSIONS: From the above research work the conclusion are as follows:

1. Maximum increase in compressive strength of concrete occurred when 10% cement and 10% coarse aggregate replacement was done with coconut shell ash and coconut shell.
2. Flexural strength is maximum when 0% cement and 15% coarse aggregate & 15% cement and 5% coarse aggregate replacement was done with coconut shell ash and coconut shell with addition of 4% coconut fibre by weight of cement.
3. Split tensile strength is maximum when 0% cement and 20% coarse aggregate & 15% cement and 5% coarse aggregate replacement was done with coconut shell ash and coconut shell with addition of 4% coconut fibre by weight of cement.

REFERENCES

{1} Yogesh Narayan Sonawane, Chetan Jaiprakash Chitte: Waste Coconut Shell as a Partial Replacement of Coarse Aggregate in Concrete Mix - An Experimental Study International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611 Volume 5 Issue 4, April 2016 www.ijsr.net

{2} Amarnath Yerramalaa Ramachandrudu Cb: Properties of Concrete with Coconut Shells as Aggregate Replacement International Journal of Engineering Inventions ISSN: 2278-7461, www.ijeijournal.com Volume 1, Issue 6 (October2012) PP: 21-31 21

{3} Utsev, J. T., Taku, J. K. Coconut Shell Ash As Partial Replacement of Ordinary Portland Cement In Concrete Production INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 1, ISSUE 8, SEPTEMBER 2012 ISSN 2277-8616 86

{4} M.Nivedhitha, Dr.M.Sivaraja Experimental Study on Partial Replacement of Cement with Coconut Shell Powder and Egg Shell Powder ISSN(Online): 2319-8753 ISSN (Print): 2347-6710 International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Website: www.ijirset.com Vol. 6, Issue 5, May 2017

{5} Parag S. Kambli, Sandhya R. Mathapati Compressive Strength of Concrete by Using Coconut Shell IOSR Journal of Engineering (IOSRJEN) www.iosrjen.org ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 04, Issue 04 (April. 2014), ||V7|| PP 01-07

{6} B.Damodhara Reddy, S.Aruna Jyothy , Fawaz Shaik3 Experimental Analysis of the Use of Coconut Shell as Coarse Aggregate IOSR Journal of Mechanical and Civil Engineering (IOSR- JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 10, Issue 6 (Jan. 2014), PP 06-13

{7} Parag S. Kambli, Sandhya R. Mathapati Application of Coconut Shell as Coarse Aggregate in Concrete: A Technical Review Parag S. Kambli et al Int. Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 4, Issue 3(Version 1), March 2014, pp.498 501

{8} Bhavana M Desai, Prof Nirav Umravia , Dr K .B. Parikh Experimental Study on Concrete by Partial Replacement of Cement with Coconut Shell Ash, Incorporating Steel Fibres: A Review www.ijraset.com Volume 5 Issue III, March 2017 IC Value: 45.98 ISSN: 2321-9653 International Journal for Research in Applied Science & Engineering Technology (IJRASET)

{9} Sanjay Sen, Rajeev Chandak Effect of coconut fibre ash on strength properties of concrete Sanjay Sen Int. Journal of Engineering Research and Applications www.ijera.com ISSN: 2248- 9622, Vol. 5, Issue 4, (Part -1) April 2015, pp.33-35

{10} K.Gunasekaran P.S.Kumar Lightweight Concrete Using Coconut Shells as Aggregate Proceedings of International Conference on Advances in Concrete and Construction, ICACC- 2008 7-9 February, 2008, Hyderabad, India pp 450-459

{11} Akshay S. Shelke, Kalyani R. Ninghot, Pooja P. Kunjekar, Shraddha P. Gaikwad Coconut Shell as Partial Replacement for Coarse Aggregate: Review ISSN 2278-3652 Volume 5, Number 3 (2014), pp. 211-214 © Research India Publications http://www.ripublication.com/ijcer.htm

{12} Kalyanapu Venkateswara Rao A.H.L.Swaroop Dr.P.Kodanda Rama Rao Ch.Naga Bharath STUDY ON STRENGTH PROPERTIES OF COCONUT SHELL CONCRETE International Journal of Civil Engineering and Technology (IJCIET), ISSN 0976 – 6308 (Print) ISSN 0976 – 6316(Online) Volume 6, Issue 3, March (2015), pp. 42-61 © IAEME: www.iaeme.com/Ijciet.asp Journal Impact Factor (2015): 9.1215 (Calculated by GISI) www.jifactor.com

{13} Neetesh Kumar Dilip Kumar Utilization of Coconut Shell in Different Forms in Concrete IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 07, 2014 | ISSN (online): 2321-0613

{14} S. A. Kakade, Dr. A. W. Dhawale LIGHT WEIGHT AGGREGATE CONCRETE BY USING COCONUT SHELL International Journal of Technical Research and Applications e- ISSN: 2320-8163, www.ijtra.com Volume 3, Issue 3 (May-June 2015), PP. 127-129

{15} Apeksha Kanojia, S.K. Jain Performance of Coconut Shell as Coarse Aggregate in Concrete: A Review International Research Journal of Engineering and Technology (IRJET) e- ISSN: 2395 -0056 Volume: 02 Issue: 04 | July-2015 www.irjet.net p-ISSN: 2395-0072

{16} Ms. Swapna S A, Mr. Pramod K An Experimental Study On the Partial Replacement Of Cement by Coconut shell ash and Coconut Shell Ash In Concrete International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 06 | June-2016 www.irjet.net p-ISSN: 2395-0072