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To Determine the Performance Level of GLASS Fibre and Coconut Shell in Concrete

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Abstract: ***Concrete is the most widely used construction material in civil engineering because of its high structural strength and stability. Concrete is the premier construction material around the world and is most widely used in all types of construction works, including infrastructure, low and high-rise buildings, and domestic developments. It is a man-made product, essentially consisting of a mixture of cement, aggregates, water and admixture(s). Inert granular materials such as sand, crushed stone or gravel form the major part of the aggregates. Traditionally aggregates have been readily available at economic prices and of qualities to suit all purposes. But, the continued extensive extraction use of aggregates from natural resources has been questioned because of the depletion of quality primary aggregates and greater awareness of environmental protection. To find a suitable and effective material from the waste product that would considerably minimize the use of material and ultimately reduce the construction cost. In this project GLASS fibre and Coconut shell were used as replacement of cement and coarse aggregate respectively. First physical properties of materials were found out and then the properties of GLASS fibre and coconut shells were also found out. In this project, experimental investigations were carried to find out the workability and strength, Durability characteristics of M20 Grade concrete with different replacement level of cement as (i.e.,5%,10%,15%,20 %) by coconut shell, 0.5% by fibre and 2% alcofin. The tests will be conducted to determine the performance level of GLASS fibre and coconut shell in concrete. The specimen will be subjected to determine compressive strength, split tensile strength at 7, 14, 28 days and flexural strength at 7, 28 days of curing period. Workability of concrete should increase by combination of GLASS fibre and coconut shell. In this project GLASS fibre will be used to increase the strength of the coconut shell concrete. GLASS fibre along with cement.***

Keyword: GLASS fibre, Coconut shell, Workability, Mechanical Property.

I. INTRODUCTION

A. General

For most nations, organisations and people who consider its importance, sustainability means the conservation of the Earth and basic issues related to improvement, such as the productive utilisation of resources, stable economic growth, consistent social advance and poverty elimination.

Sustainable construction aims to meet current requirements for housing, working environment and infrastructure without compromising the capacity of future generations to meet their own needs. Environmental sustainability can be achieved in this sector by replacing conventional aggregates in concrete with solid waste aggregates. Coarse and fine aggregates account approximately 60%–80% of concrete volume.

B. Objectives of the Study

1) To study the effect of coconut shells in concrete and its benefits.
2) To study the test results of compressive and some percentage of replacement of cement. Strength water absorption, slump cone between plain concrete and concrete added with coconut shells.

II. LITERATURE REVIEW

Ahmed Towheed Molvi and Sandeep Singh (2023) the primary objective of the research was to match the results produced by using filler such as fly ash with coconut shell charcoal ash in bituminous concrete. Marshall stability test stability, flow value, VMA and void ratio was performed.

The Marshall stability increases with the increase of filler in the Marshall cake. The flow value increases with the increase of coconut shell charcoal as a filler and decreases the void ratio and VMA with the increase of filler. The different percentage of coconut shell charcoal ash are 1%, 1.5%, 2%, 2.5% and 3% are used in test with 5.5% bitumen. Results stated that coconut shell charcoal ash as a filler may be utilized because of its filler properties since it meets all of the requirements. Coconut shell charcoal as a filler in roads is durable and also less cost.

S. Prajapati and K.S Tirpude (2022) in the research paper, M20 grade of concrete was prepared by using coconut shell as coarse aggregate. Experimental work coarse aggregate was replaced by 5%, 10%, 15%, 20%, 25%, 30% and 35% of coconut shell.Variation of compressive strength after 28 days with the replacement percentage of coconut shell aggregate was between 5-15%. It shows that the compressive strength value was approximately near to the target mean strength value of M20 grade of concrete. The compressive strength varies from 25 to 21 N/mm2 for 0% to 35% replacement of coarse aggregate with coconut shell aggregate. The split tensile strength value was near to target mean strength value when percentage replacement of coarse aggregate as coconut shell aggregate is between 5-15%. The split tensile strength varies from 2.80 to 2.42 N/mm2 for 0% to 35% replacement of coarse aggregate as coconut shell aggregate. The flexural strength varies from 3.15 to 3.30 N/mm2 for 0% to 35% replacement of coarse aggregate with coconut shell aggregate. Experiment shows that flexural strength value was near to target mean strength value when the replacement percentage is between 5-15%. According to test after 15% replacement of coarse aggregate by coconut shell aggregate the strength value of concrete is decreased.

III. MATERIALS AND METHODS

The detailed experimental programmer design of in this chapter. It covers materials concrete component testing, mix proportioning, experiment details, and test sets, among other things.

A. Materials

1) Cement
2) Sand
3) Aggregate
4) Fly ash
5) Coconut Shell
6) Water

Table 1 Design Mix

Mix Id	Fibre %	Replacement of Coarse Aggregate with coconut shell	Cement (Kg)	FA (Kg)	CA (Kg)	Fly Ash (Kg)
CC	0%	0%	372	645	1152	0
C1	0.50%	10%	372	645	1037	115
C2		20%	372	645	922	230
C3		30%	372	645	807	345
C4	1%	10%	372	645	1037	115
C5		20%	372	645	922	230
C6		30%	372	645	807	345
C7	1.50%	10%	372	645	1037	115
C8		20%	372	645	922	230
C9		30%	372	645	807	345

IV. METHODOLOGY

The aim is to determine the characteristics of constituent materials and strength of concrete produced by replacing coarse aggregate by coconut shell and cement by fly ash. Several experimental works are carried out. Thus the work study is laboratory oriented.

1) *Step 1*- The materials such as cement, coconut shell, fine aggregate, coarse aggregate, M20 grade concrete and required slump are chosen.
2) *Step 2*- The materials have been collected from a specific location and properties have been studied.
3) *Step 3*- Using these properties, mix design is carried out with suitable w/c ratio for M20 grade of concrete.
4) Step 4- Required slump is obtained experimentally by slump cone test.
5) *Step 5*- Concrete cubes, using coconut shells as a partially replacement of coarse aggregate will be cast to study the compressive strength of concrete. Then the cubes will be tested in compression testing machine.
6) *Step 6*- The compressive strength of the concrete will be determined by using 150 mm concrete cube specimens. The specimens will be tested at 7, 28 and 56 days age, in 200 tons capacity hydraulic type compression-testing machine. The cube compressive strength will be obtained by considering the average of three specimens at each age.
7) *Step 7*- Using 150mm by 300mm Cylinders, using coconut shells as a partially replacement of coarse aggregate will be cast to study the split tensile strength of concrete. The specimens will be tested 7, 28 and 56 days age, in 200 tons capacity hydraulic type compression-testing machine. The tensile strength will be obtained by considering the average of three specimens at each age.
8) *Step 8*- Beam members (100mmX100mmX500mm), using coconut shells as a partially replacement of coarse aggregate will be cast to study the flexural strength of concrete. The specimens will be tested 7, 28 and 56 days age, in 200 tons capacity hydraulic type flexure-testing machine.
9) *Step 9*- Then the beams will be tested in single point loading, and deflections under the load points will be recorded. The flexure strength will be obtained by considering the average of three specimens at each age.
10) *Step 10*- The test specimens are stored in place free from vibration, in moist air of at least 90% relative humidity and at a temperature of 27o +2oC for 24 hours from the time of addition of water to the dry ingredients. After this period, the specimens are marked and removed from the moulds and immediately submerged in clean fresh water and kept there until taken out just prior to test. The water in which the specimens are submerged, are renewed every seven days and maintained at a temperature of 27o +2oC. The specimens are not allowed to become dry at any time until they have been tested.
11) *Step 11*- Using 150mm concrete cube specimen, durability property-water absorption will be determined after 28 days age.
12) *Step 12*- The density of concrete coarse aggregate replaced with coconut shell will be observed and compared.
13) *Step 13*- All test results are tabulated systematically.
14) *Step 14*- Conclusions are drawn based on test results.

V. RESULT AND DISCUSSION

For the design mix values of concrete material required for per cubic meter is mentioned and the Variation of Compressive strength, Flexural strength and Split tensile strength of Glass fibre reinforced concrete mixes with variation in coconut shell is compared with ordinary concrete mixes. The slump results, strength results and durability results were identified, tabulated and graphically presented in this section.

A. Test Results on Fresh Concrete

Workability of the fresh concrete is done through slump cone test for different percentage replacement of the coconut shell and fibre reinforced and control concrete.

From the results tabulated workability decreased with percentage increase in replacement of coarse aggregate with coconut shell as well as with percentage increase in addition of fibre content. The workability decreased from 40mm for control concrete to 5mm for concrete with 30% coconut shell aggregate replacement and 1.5% fibre addition..

Table 2 Slump Values Of Concrete Mixes For Various Percentages Of Coconut shell Replacement and addition of fibres.

Mix Id	Slump
CC	40
C1	40
C2	30
C3	28
C4	38
C5	27
C6	26
C7	36
C8	28
C9	25

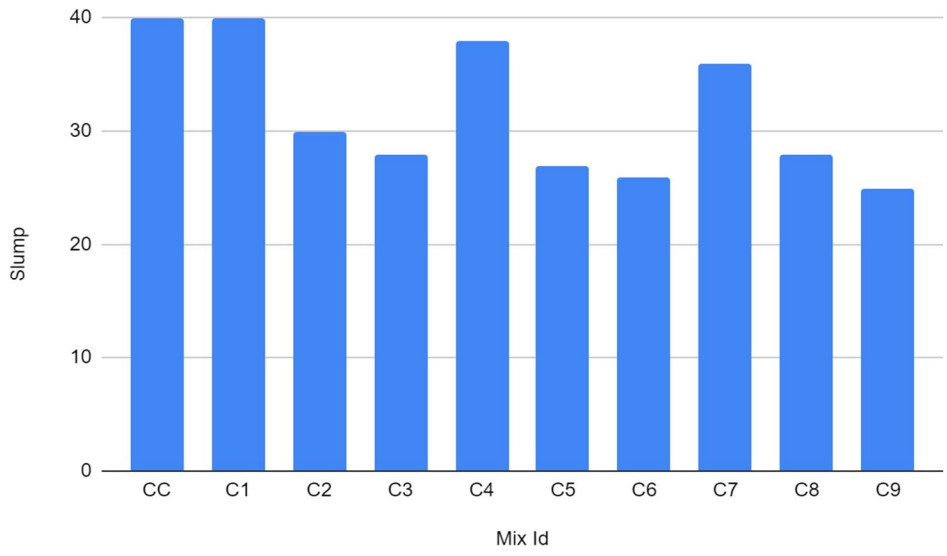


Fig 1 Slump Test in mm

Inference- The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions. The slump values as per standard reference condition always lies between 25-50mm.and shape of aggregate should be angular. The slump values were found favourable for conventional concrete and similar values were visible for the C1 and C4.

B. Test Results on Hardened Concrete

1) Compressive Strength Test

Table 3 Compressive Strength in N/mm2

Compressive Strength N/mm2				
Mix Id	Fibre %	Replacement of Coarse Aggregate with coconut shell	7 days Strength (Mpa)	
CC	0%	0%	13.2	18.03
C1	0.50%	10%	17.5	22
C2		20%	13.7	21.36
C3		30%	13.4	20.09
C4	1%	10%	18.3	23.89
C5		20%	14.1	21.76
C6		30%	13.9	20.87
C7	1.50%	10%	18.2	23.03
C8		20%	13.98	21.54
C9		30%	13.76	21.32

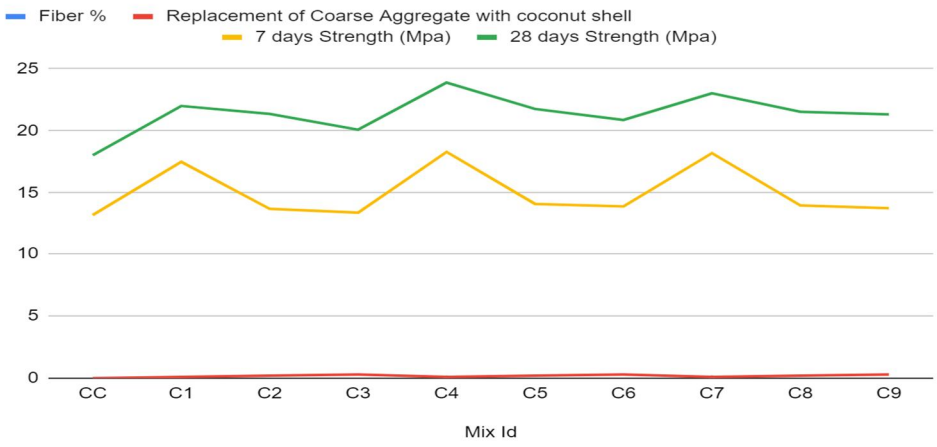


Fig 2 Compressive Strength Test in N/mm2.

Inference- Compressive strength is the ability to carry loads of material or structure on its surface without any cracking or deformation. An object under compression will reduce in size and, under tension, the size will continue to lengthen. The Compressive strength test helps to identify the overall strength and the above factors. By conducting this test, one can easily determine the strength psi of the concrete and the quality of the concrete being produced. The compressive strength was found maximum for sample C4 with 23.89 kN/m2 and similar results were found for the C7 and further concrete mix with addition of coconut shell reduces the strength of the concrete cube.

2) Flexural Strength Test

Table 4 Flexural Strength Test in N/mm2

Flexural Strength in N/mm2				
Mix Id	Fibre %	Replacement of Coarse Aggregate with coconut shell	7 days Strength (Mpa)	28 days Strength (Mpa)
CC	0%	0%	1.94	2.25
C1	0.50%	10%	2.02	3.11
C2		20%	2.75	3.32
C3		30%	2.65	3.29
C4	1%	10%	2.12	3.25
C5		20%	2.89	3.51
C6		30%	2.63	3.25
C7	1.50%	10%	2.46	3.75
C8		20%	2.57	3.81
C9		30%	2.51	3.79

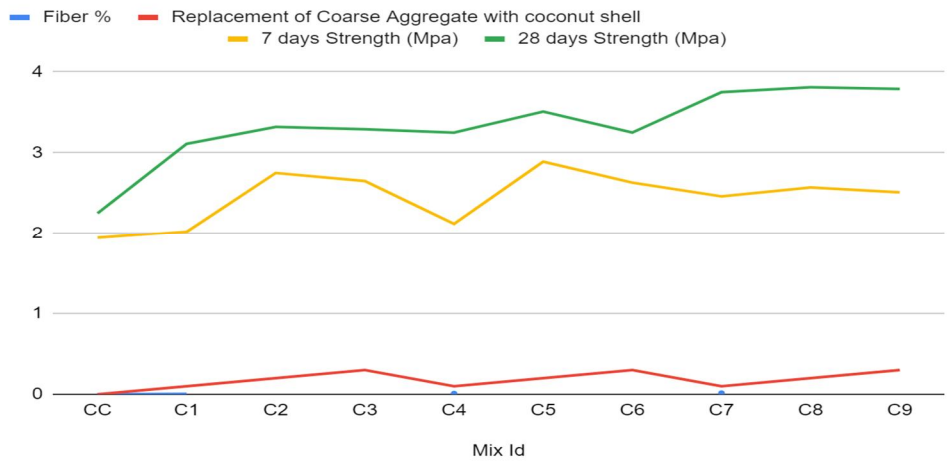


Fig 3 Flexural Strength in N/mm2

Inference- Flexural strength of Concrete, also known as Modulus of rupture, is an indirect measure of the tensile strength of unreinforced concrete. Modulus of rupture can also be defined as the measure of the extreme fibre stresses when a member is subjected to bending. Apart from external loading, tensile stresses can also be caused by warping, corrosion of steel, drying shrinkage and temperature gradient. The Flexural strength test was evaluated for 7 days and 28 days. The strength of the concrete was found to increase from C1 to C8 but further addition of concrete shell reduced the strength of the cubes.

Split Tensile Strength Test

Table 5 Split Tensile Strength test in N/mm2

Split Tensile Strength in N/mm2				
Mix Id	Fibre %	Replacement of Coarse Aggregate with coconut shell	7 days Strength (Mpa)	28 days Strength (Mpa)
CC	0%	0%	0.92	1.26
C1	0.50%	10%	1.08	1.45
C2		20%	1.28	1.77
C3		30%	0.95	1.49
C4	1%	10%	1.12	1.48
C5		20%	1.33	1.81
C6		30%	0.98	1.53
C7	1.50%	10%	1.11	1.46
C8		20%	1.32	1.8
C9		30%	0.97	1.52

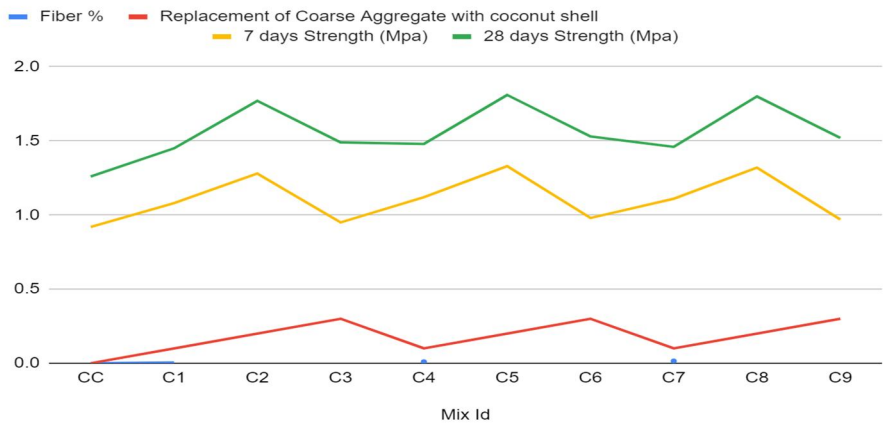


Fig 4 Split Tensile Strength Test inN/mm2.

Inference- The splitting tensile strength test is performed on hardened concrete to determine its tensile strength. Marginal variations in water to cement ratio, ingredient proportioning, increase in a slump, etc impacts the desired concrete strength. This in turn affects the strength and stability of structures. There are several tests to determine the strength of concrete. Quality tests are to be conducted on concrete at various stages starting from the production stage to the hardened stage, and on structures. Quality tests play an important role in ensuring the construction quality.

The strength was found to increase with addition of concrete shell and glass fibre, where maximum strength was visible in C5 and C8 and the strength reduces with the samples further.

VI. CONCLUSION AND FUTURE SCOPE

To find a suitable and effective material from the waste product that would considerably minimize the use of material and ultimately reduce the construction cost. In this project GLASS fibre and Coconut shell were used as replacement of cement and coarse aggregate respectively. First physical properties of materials were found out and then the properties of GLASS fibre and coconut shells were also found out. In this project, experimental investigations were carried to find out the workability and strength, Durability characteristics of M20 Grade concrete with different replacement level of cement as (i.e 10% ,20 % and 30%) by coconut shell, 0.5%, 1% and 1.5% by fibre and 2% alcofin.

The tests will be conducted to determine the performance level of GLASS fibre and coconut shell in concrete. The specimen were subjected to determine compressive strength, split tensile strength at 7, 14, 28 days and flexural strength at 7, 28 days of curing period. Workability of concrete should increase by combination of GLASS fibre and coconut shell. In this project GLASS fibre was used to increase the strength of the coconut shell concrete. GLASS fibre along with cement. From the durability test, the weight loss due to acid attack and sulphate attack of concrete should be lower than the conventional concrete.

A. Slump Value Results

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions. The slump values as per standard reference condition always lies between 25-50mm.and shape of aggregate should be angular. The slump values were found favourable for conventional concrete and similar values were visible for the C1 and C4.

B. Compressive Strength

Compressive strength is the ability to carry loads of material or structure on its surface without any cracking or deformation. An object under compression will reduce in size and, under tension, the size will continue to lengthen. The Compressive strength test helps to identify the overall strength and the above factors. By conducting this test, one can easily determine the strength psi of the concrete and the quality of the concrete being produced. The compressive strength was found maximum for sample C4 with 23.89 kN/m2 and similar results were found for the C7 and further concrete mix with addition of coconut shell reduces the strength of the concrete cube.

C. Flexural Strength

Flexural strength of Concrete, also known as Modulus of rupture, is an indirect measure of the tensile strength of unreinforced concrete. Modulus of rupture can also be defined as the measure of the extreme fibre stresses when a member is subjected to bending. Apart from external loading, tensile stresses can also be caused by warping, corrosion of steel, drying shrinkage and temperature gradient. The Flexural strength test was evaluated for 7 days and 28 days. The strength of the concrete was found to increase from C1 to C8 but further addition of concrete shell reduced the strength of the cubes.

D. Split Tensile Strength

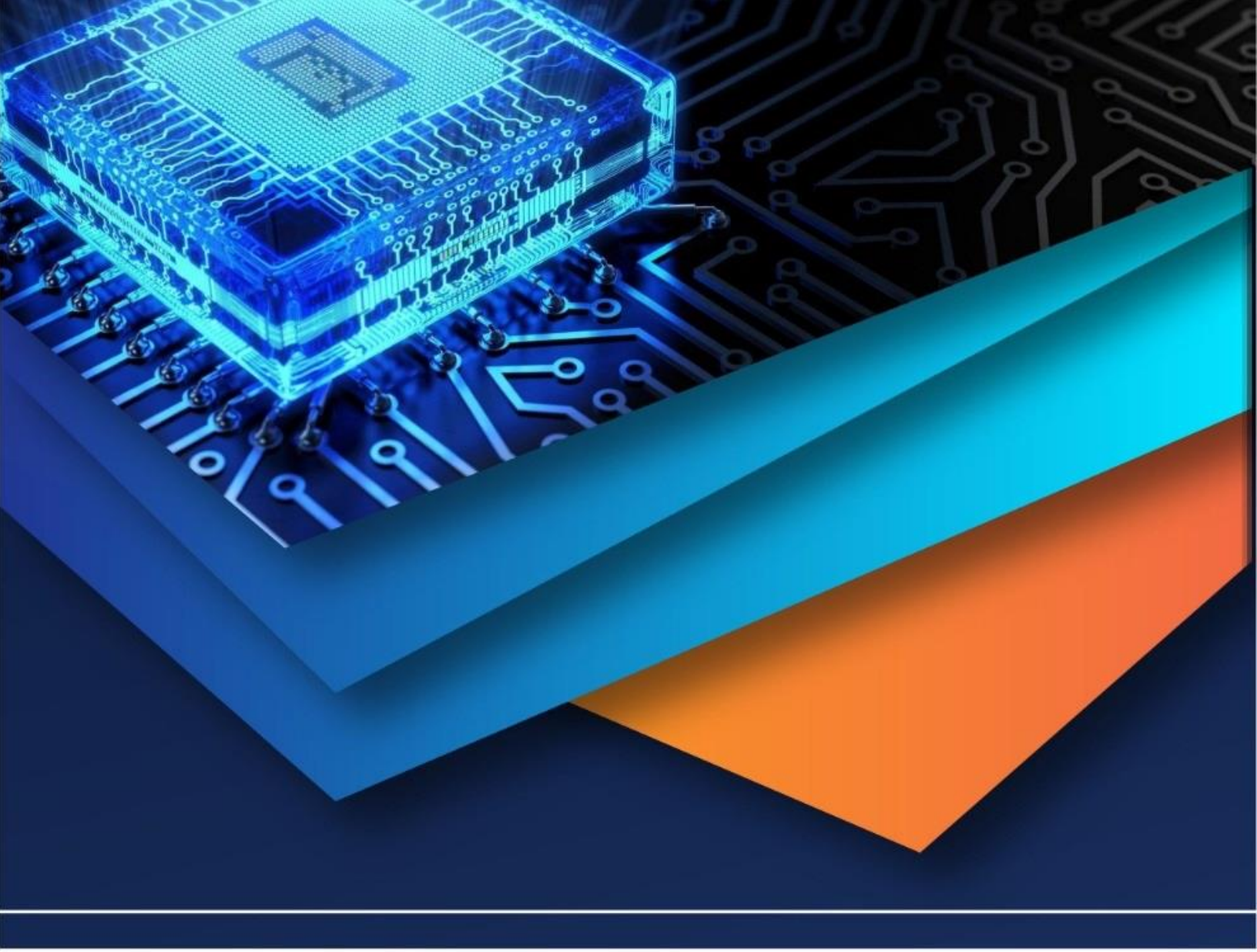
The splitting tensile strength test is performed on hardened concrete to determine its tensile strength. Marginal variations in water to cement ratio, ingredient proportioning, increase in a slump, etc impacts the desired concrete strength. This in turn affects the strength and stability of structures. There are several tests to determine the strength of concrete. Quality tests are to be conducted on concrete at various stages starting from the production stage to the hardened stage, and on structures. Quality tests play an important role in ensuring the construction quality. The strength was found to increase with addition of concrete shell and glass fibre, where maximum strength was visible in C5 and C8 and the strength reduces with the samples further.

REFERENCES

[1] Ayyappa R A, Sandeep Reddy B, G. Swamy Yadav and Dara Swetha Sudarshan, [Partial Replacement of Cement and Coarse Aggregate by Egg Shell Powder and Coconut Shells], International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075 (Online), Volume-9 Issue-4, February 2020.

[2] Kaniz Fatema, Md. Ashraful Alam and Mahbubur Rahman, [PERFORMANCE OF GREEN CONCRETE BLOCK ENCOMPASSING FLY ASH AND GROUND GRANULATED BLAST FURNACE SLAG], International Research Journal of Modernization in Engineering Technology and Science, Volume:03 /Issue:10/ October-2021.

[3] V. R. Prasath Kumar and K.Gunasekaran, [THE EFFECT OF ALCCOFINE IN COCONUT SHELL CONCRETE AND EXAMINING BOND THROUGH INVERTED METALLURGICAL MICROSCOPE], Rasayan J. Chem.Vol. 12 | No. 4 |2218 - 2226| October - December | 2019, ISSN: 0974-1496.
[4] P.Deepa and M. Arul Kumar, [Experimental Study On Hybrid Fibre Concrete With Using GLASS fibre And M Sand], International Journal of Engineering Development and Research, 2018 | Volume 6, Issue 2 | ISSN: 2321-9939.
[5] Virendra Desale, Aarti Kamble, Palash Borwal, Akshay Ingole and Sudhanshu Pathak, [Experimental Analysis of Partial Replacement of Cement by Glass fibre and Fly Ash in Concrete], International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 7 Issue 05, May-2018.
[6] Yusuf Jamal, Ranoo Sharma, Mohammad Raiyan, Akash Chaudhary and Ayush Srivastava, [BEHAVIOUR OF REINFORCED CONCRETE BEAMS WITH COCONUT SHELLS AS COARSE AGGREGATES], International Journal of Advance Research in Science and Engineering, Volume no 10, Issue no 07, July 2021.
[7] M. Thamarai Selvi, V. Balasubramanian and T. D. Ramadsan, [Study on Concrete with Partial Replacement of Cement by GLASS fibre and Coarse Aggregate by Coconut Shell], International Journal of Engineering Science and Computing, April 2019, Volume 9 Issue No. 4.
[8] Krishnaveni (2018), 'Study on partial replacement of cement by GLASS fibre and garbage ash', International Journal of Engineering Science and Computing, Volume 8, Issue 4, PP 16787- 16791.
[9] V.Vinod (2017), ' Study on strength properties of concrete by partial replacing cement with GLASS fibre', International Journal of Engineering and Technology IJCIET, Volume 8, Issue 4, PP 2044-2048.
[10] Parthasarathi, N., Prakash, M., & Satyanarayanan, K. S. (2017). Experimental study on partial replacement of cement with egg shell powder and silica fume. Rasayan Journal of Chemistry, 10(2), 442–449. https://doi.org/10.7324/RJC.2017.1021689
[11] Saifullah, I., Rahman, M. M., Halim, A., & Islam, R. (2019). Mechanical and Bond Properties of Lightweight Concrete Incorporating Coconut Shell as Coarse Aggregate. American Journal of Civil Engineering and Architecture, 7(1), 38–46. https://doi.org/10.12691/ajcea-7-1-5
[12] Sathvik, S., Edwin, A., Basnett, A., Sharma, P., & Carmicheal, J. (2019). Experiment of partial replacement of egg shell powder and coconut fibre in concrete. International Journal of Innovative Technology and Exploring Engineering, 8(6 Special Issue 4), 1034–1038. https://doi.org/10.35940/ijitee.F1213.0486S419
[13] MD Ikramullah Khan, Bhavani Challa, S.Haripriya (2019), Sorptivity and Durability Assessment of Dolomite Impregnated Ternary Concrete, International Journal of Recent Technology and Engineering, ISSN: 2277-3878, Volume-8 Issue-2, July 2019.
[14] E.Laxmi Prasanna,B.tipraj, S.Haripriya,(2019),Mechanical Properties of Fly Ash Based Concrete Aided With Recycled Aggregates and Manufactured Sand, International Journal of Recent Technology and Engineering, ISSN: 2277-3878, Volume-8 Issue-4, November 2019



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