North Asian International Research Journal of Sciences, Engineering & I.T.

IRJIF. I.F. : 3.821

ISSN: 2454-7514 Vol. 9, Issue-6, June-2023

Index Copernicus Value: 52.88 Indian Citation Index Thomson Reuters ID: S-8304-2016

A Peer Reviewed Refereed International Journal

EXPERIMENTAL INVESTIGATION ON RECRON 3S FIBER CONCRETE WITH OYSTER SHELL POWDER AND BAMBOO CHIPS

[1]J.SREE NAGA CHAITANYA, [2]DR.K.CHANDRAMOULI, [3]SK.SAHERA,[4]SYED YASIN

[1,3] Assistant Professor,[2]Professor & HOD,[4]B. Tech Student

[1,2,3,4] Department of Civil Engineering, NRI Institute of Technology, Visadala (V), Medikonduru (M), Guntur, Andhra Pradesh, INDIA .

Email:jarugumillichaitanya1989@gmail.com, koduru_mouli@yahoo.com

ABSTRACT

Concrete is the most widely used construction material, but its production causes high consumption of cement and natural aggregates, leading to environmental concerns. To overcome these issues, sustainable alternatives are being investigated. In this study, Recron 3S fibers are used as an additive in concrete to improve crack resistance and toughness. Oyster shell powder, which is rich in calcium, is employed as a partial replacement for cement, reducing cement consumption and associated CO_2 emissions. Bamboo chips, a renewable natural material, are used as a partial replacement for coarse aggregates, promoting eco-friendly use of resources. The experimental program involves preparing concrete mixes with these materials and casting standard cube and cylinder specimens. The specimens are cured under standard conditions and tested for mechanical properties. Compressive strength tests are conducted at 7 and 28 days to evaluate the load-bearing capacity. Split tensile strength tests are also carried out at the same curing Oyster shell powder is examined for its cementitious contribution and strength development. Bamboo chips are assessed for their suitability in partially replacing coarse aggregates without compromising durability. This research encourages the use of industrial and natural waste products in concrete. It also promotes cost-effective, eco-friendly, and sustainable construction practices. Overall, the study provides valuable insights into the feasibility of innovative materials for producing durable concrete.

KEYWORDS: ***Recron 3s,Bamboo chips, Oystershell powder,sustainability,Compressive strength and Split tensile strength***

1. INTRODUCTION

Concrete is the most widely used construction material in the world. It is a composite material made by mixing cement, fine aggregates (sand), coarse aggregates (gravel or crushed stone), and water in suitable proportions. When these ingredients are combined, a chemical reaction called hydration takes place, which binds the materials together and allows the concrete to harden over time. Concrete is known for its high compressive strength, durability, and ability to be molded into any desired shape before setting.

Oyster shell powder is an eco-friendly material obtained from discarded oyster shells, which are mainly composed of calcium carbonate. Large amounts of oyster shells are generated as waste from the seafood industry, causing disposal and environmental problems. Converting these shells into powder provides a sustainable solution by recycling waste into useful construction material. Due to its high calcium content, oyster shell powder shows cementitious properties similar to limestone used in cement production. When used as a partial replacement of cement in concrete, it helps reduce cement consumption and lowers CO_2 emissions. It can improve certain properties of concrete, such as durability and long-term strength development. At the same time, it reduces dependency on natural raw materials used for cement production. Thus, oyster shell powder acts as a sustainable alternative, promoting eco-friendly and cost-effective concrete.

Bamboo chips are a sustainable and renewable material obtained by cutting and processing bamboo into small pieces. They are lightweight, strong, and easily available in many regions, making them a suitable alternative construction material. In concrete, bamboo chips can be used as a partial replacement of coarse aggregates like gravel or crushed stone. This replacement helps reduce the consumption of natural stone aggregates, conserving natural resources. Bamboo also has good tensile strength and toughness, which can enhance the mechanical performance of concrete. Using bamboo chips contributes to eco-friendly construction by utilizing renewable resources and reducing environmental impact.

Recron 3S fibers are synthetic polyester fibers specially designed to be used as an additive in concrete and mortar. They are added in small quantities to improve the performance of concrete by controlling shrinkage cracks. The fibers act as secondary reinforcement, bridging microcracks and preventing their propagation. This improves the ductility, toughness, and durability of concrete. Recron 3S fibers also enhance resistance against impact, abrasion, and seepage of water. Their uniform distribution in the concrete matrix increases overall structural integrity. By reducing early-age cracking, they improve the service life of concrete structures. Thus, Recron 3S fibers provide a cost-effective solution for producing stronger, more durable, and crack-resistant concrete.

2. OBJECTIVES

1. **To evaluate the effect of Recron 3S fibers**as an additive in concrete for improving crack resistance, ductility, and overall durability.
2. **To study the influence of oyster shellpowder** as a partial replacement of cement on the compressive and tensile strength properties of concrete.
3. **To investigate the use of bamboo chips** as a partial replacement of coarse aggregates and assess their impact on the strength and sustainability of concrete.

3. MATERIALS

3.1 Cement:-Cement is a binding material used in construction, made from limestone and clay. When mixed with water, it undergoes hydration and hardens to bind aggregates together. It provides strength, durability, and cohesion in concrete.

3.2 Fine Aggregate:-Fine aggregate refers to naturally occurring sand or crushed stone passing through a 4.75 mm sieve. It fills voids between coarse aggregates and improves workability of concrete. It contributes to strength and smooth finish.

3.3 Coarse Aggregate:-Coarse aggregate consists of gravel or crushed stone retained on a 4.75 mm sieve. It forms the main skeleton of concrete and provides bulk and strength. It reduces shrinkage and increases load-bearing capacity.

3.4 Water:-Water is an essential component of concrete, required for the hydration of cement. It ensures proper workability and setting of concrete mix. The quality and quantity of water directly affect concrete strength.

3.5 Oyster Shell Powder:-Oyster shell powder is a waste material obtained by grinding discarded oyster shells. Rich in calcium carbonate, it shows cementitious properties. It can be used as a partial replacement of cement in concrete.

3.6 Bamboo Chips:-Bamboo chips are small pieces of processed bamboo used as a renewable aggregate. They are lightweight and strong, serving as a partial replacement of coarse aggregates. Their use reduces natural resource consumption.

3.7 Recron 3S Fibbers:-Recron 3S fibers are synthetic polyester fibers added in small quantities to concrete. They control plastic shrinkage cracks and improve toughness. They enhance durability, ductility, and resistance to impact and seepage.

4. EXPERIMENTAL RESULTS

4.1 Compressive strength:-In this test, concrete cubes of standard size (usually 150 mm × 150 mm × 150 mm) are cast and cured. After 7 or 28 days, the cubes are placed in a compression testing machine. Load is applied gradually until failure, and the maximum load is used to calculate compressive strength.

Table 1: Compressive strength results of concrete oyster shell powder as partial replacement of cement.

Sl.no	% of oyster shell powder	Compressive Strength Results, N/mm^2	
		7 days	28 days
1	0%	26.98	39.34
2	5%	28.13	40.31
3	10%	29.23	41.83
4	15%	29.09	41.62

Table 2: Compressive strength results of concrete bamboo chips as partial replacement of coarse aggregate.

Sl.no	% of bamboo chips	Compressive Strength Results, N/mm^2	
		7 days	28 days
1	0%	26.98	39.34
2	6%	28.03	40.87
3	12%	28.96	41.72
4	18%	28.72	41.09

Table 3: Compressive strength results of concrete by addition of recron 3s fiber .

Sl.no	% of recron 3s fibers	Compressive Strength Results, N/mm^2	
		7 days	28 days
1	0%	26.98	39.34
2	0.25%	27.95	40.81
3	0.5%	28.67	41.62
4	0.75%	29.73	42.46
5	1%	28.57	41.12

Table 4: Compressive strength results of Combined replacement of 10%OSP+12%BC+0.75%3SRF in concrete.

Sl.no	10%OSP+12%BC+0.75%3SRF	Compressive Strength Results, N/mm^2	
		7 days	28 days
1	0%	26.98	39.34
2	10%OSP+12%BC+0.75%3SRF	31.37	44.89

4.2 Split tensile strength: - **Split tensile strength** is an indirect method to evaluate the tensile resistance of concrete, since concrete is inherently weak in direct tension. In this test, a cylindrical specimen is placed horizontally and a compressive load is applied along its diameter. This loading induces tensile stresses inside the cylinder, causing it to split along the loaded diameter. The test is carried out at 7 and 28 days of curing to study the cracking behavior and tensile strength development of concrete.

Table 5: Split tensile strength results of concrete oyster shell powder as partial replacement of cement.

Sl.no	% of oyster shell powder	Split tensile Strength Results, N/mm^2

		7 days	28 days
1	0%	2.63	3.86
2	5%	2.76	3.99
3	10%	2.89	4.14
4	15%	2.82	4.09

Table 6: Split tensile strength results of concrete bamboo chips as partial replacement of coarse aggregate.

Sl.no	% of bamboo chips	Split tensileStrength Results, N/mm^2	
		7 days	28 days
1	0%	2.63	3.86
2	6%	2.78	4.04
3	12%	2.84	4.11
4	18%	2.79	4.06

Table 7: Compressive Split tensile strength results of concrete by addition of recron 3s fiber .

Sl.no	% of recron 3s fibers	Split tensile Strength Results, N/mm^2	
		7 days	28 days
1	0%	2.63	3.86
2	0.25%	2.76	4.01
3	0.5%	2.92	4.13
4	0.75%	2.98	4.19
5	1%	2.85	4.08

Table 8: Split tensile strength results of combined replacement of 10%OSP+12%BC+0.75%3SRF in concrete.

Sl.no	10%OSP+12%BC+0.75%3SRF	Split tensileStrength Results, N/mm^2	
		7 days	28 days
1	0%	2.63	3.86
2	10%OSP+12%BC+0.75%3SRF	3.15	4.52

5. CONCLUSION

1. The normal concrete without any replacement achieved a compressive strength of **26.98 N/mm² at 7 days**and**39.34 N/mm² at 28 days.**
2. The use of **oyster shell powder (OSP) as a partial replacement of cement** showed the optimum strength at **10% replacement**, reaching **29.23 N/mm² at 7 days**and **41.83 N/mm² at 28 days.**
3. The use of **bamboo chips (BC) as a partial replacement of coarse aggregate** yielded the best results at **12% replacement,** with strengths of **28.96 N/mm² at 7 days** and **41.72 N/mm² at 28 days**.
4. The addition of **Recron 3S fibers** showed maximum improvement at **0.75% addition**, achieving **29.73 N/mm² at 7 days** and**42.46 N/mm² at 28 days.**
5. The **combined replacement of 10% OSP + 12% BC + 0.75% Recron 3S fibers** gave the highest strength, reaching **31.37 N/mm² at 7 days**and **44.89 N/mm² at 28 days**, which is significantly higher than normal concrete.
6. The normal concrete without any replacement achieved a split tensile strength of **2.63 N/mm² at 7 days**and**3.86 N/mm² at 28 days.**
7. The use of **oyster shell powder (OSP) as a partial replacement of cement** showed the optimum strength at **10% replacement,** reaching**2.89 N/mm² at 7 days**and**4.14 N/mm² at 28 days.**
8. The use of **bamboo chips (BC) as a partial replacement of coarse aggregate** yielded the best results at **12% replacement,** with strengths of**2.84 N/mm² at 7 days** and **4.11 N/mm² at 28 days.**
9. The addition of **Recron 3S fibers** showed maximum improvement at **0.75% addition,** achieving **2.98 N/mm² at 7 days** and **4.19 N/mm² at 28 days.**
10. The **combined replacement of 10% OSP + 12% BC + 0.75% Recron 3S fibers** gave the highest split tensile strength, reaching **3.15 N/mm² at 7 days**and**4.52 N/mm²at 28 days,** which is significantly higher than normal concrete.

6. REFERENCES

1. Maneeth P D, Shreenivas Reddy Shahapur, Shivaraj S Jewargi, G Sridevi. To Evaluate the Properties of Concrete Including using Oyster Shell Powder in Place of Cement. Indian Journal of Natural Sciences, Vol. 12 Issue 70, February 2022.
2. MO Kim. Strength and Microstructural Changes in Cementitious Composites with Waste Oyster Shell Powder (WOSP): A Long-Term Study. *Buildings* (MDPI), 2023.
3. I Cha**.** Enhancing Compressive Strength in Cementitious Composites Using Oyster Shell Powder with Admixtures. *Buildings* (MDPI), 2023.
4. K.Chandramouli , N. Pannirselvam, J. Sree Naga Chaitanya , G. Hymavathi. Experimentalinvestigation on AR glass fiber reinforced concrete with silica fume,6th International Conference on Recent Advances in Material Chemistry,68, 2022, Pages 136-138.
5. G Wang. Physical and Mechanical Properties of Sustainable Bamboo Aggregates Used in Concrete. *Elsevier*, 2024.
6. SS Park. Mechanical Properties of Concrete with Bamboo Chips as Coarse Aggregate Replacement. *Applied Sciences* (MDPI), 2019.

7. Ripudaman Singh, Sourabh Lalotra. Experimental Study on Behaviour of Concrete by Partial Replacement of Coarse Aggregate with Bamboo Pieces and Cement with Alccofine. *IJRASET*, 2022.
8. Sundaram Venkatraman, R. Vasudevan. *Study on strength parameters of plain cement concrete added with tamarind kernel powder*. *Structural Concrete*, 22(S1): E843–E850, 2021.
9. DR.K.CHANDRAMOULI, J.SREE NAGA CHAITANYA, .M.CHAITANYANAVA KUMAR AND Y.PREM NIKHIL.An Experimental Investigation on Concrete by Zeolite Powder as Partial Replacement of Fine Aggregate and Coarse Aggregate With Bamboo Chips.North Asian International Research Journal of Sciences, Engineering & I.T,9(10),October-2023.
10. R Jagadheeswari. Experimental Study to Reduce Cracks and Enhance Strength & Durability by Appending Recron 3S Fibre. *Elsevier Article* (2022).
11. J. SREE NAGA CHAITANYA, DR.K. CHANDRAMOULI, SK.SAHERA,DR.D.VIJAYAKUMAR,5M. SIREESHA.STRENGTH STUDIES ON GRAPHENE OXIDEAND METAKAOLIN AS PARTIALREPLACEMENT OF CEMENT ANDQUARRY DUST AS PARTIAL REPALCEMENT OFFINEAGGREGATE INCONCRETE,North Asian International Research Journal of Sciences, Engineering & I.T,9(5),May-2023.
12. Anonymous (IJIRT published). Impact of Recron 3S Fibers on Concrete Mechanical Properties and Microstructure. *IJIRT*, published ~6 months ago.
13. J. Sree Naga Chaitanya, Dr. K. Chandramouli, Dr. D. Vijaya Kumar, P. Dileep.Strength studyon Comparative of Banana FibreReinforced Concrete with NormalConcrerte,International Journal for Research in Applied Science & EngineeringTechnology (IJRASET),10(8),Aug 2022.
14. Ch. Kirthini, T. Sujatha. *Effect of Incorporating Metakaolin on the Properties of High Performance Concrete*. *International Journal of Engineering Research & Technology (IJERT)*, Vol 03, Issue 10, October 2014.
15. K.Chandramouli , N.Pannirselvam ,J.Sree Naga Chaitanya, andG.Hymavathi.Experimental Investigation on Self Compacting Concrete with SilicaFume,International Conference on Smart Materials and Structures(ICSMS),2810(1),June 22 2023.
16. M Prabu, I Mohammed Rafi, M Sathees Kumar. Experimental Investigation on Concrete Using Recron Fibre as Reinforcement. International Journal of Innovative Research in Science, Engineering and Technology (IJI RSET), Vol. 8 Issue 3, March 2019.