International Journal of Scientific & Engineering Research Volume 10, Issue 5, May-2019
ISSN 2229-5518

Experimental Study on Pineapple Leaf Fiber Reinforced Concrete

Hisana KP, Mohammed Suhail Parathodika, Ajeesh K

Abstract— From the ancient times, many experiments were tried on plain cement concrete by adding several fibers to improve mechanical properties of concrete. In recent years many were interested on making low cost construction materials by using natural fibers for the purpose of environmental protection. Among these, pineapple leaf fiber (PALF) has most desirable mechanical properties. Through this study, we tried to improve the mechanical properties of concrete by adding PALF in the aspect ratio 450 and conducted experiments on concrete such as compressive strength, flexural strength and split tensile strength tests in the percentage of 0.05, 0.1, 0.15 and 0.2 by weight of cement. From the experiment we got the optimum value of PALF as 0.1% by weight of cement, which showed an increase of 82.3%, 43.24% and 35.24% in compressive strength, split strength and flexural strength respectively as compared to plain cement concrete.

Index Terms— compressive strength, concrete, flexural strength, low cost construction, mechanical property, pineapple leaf fiber, split tensile strength.

1 Introduction

NOWADAYS the construction industry mainly focused the way of sustainable development by using the construction materials which are eco-friendly. And there by also can reduce the whole cost of construction. By the use of such materials it is also ensured that there is no change in desirable properties of conventional concrete. Many natural fibers are introduced in concrete industry and many of them have proved to be an alternative of steel fibers.

Pineapple leaf fibre (PALF) is a consonant natural fiber by considering chemical composition and material properties. In this study add PALF in conventional M20 mix concrete by specific aspect ratio and in different percentage by weight of binding material (cement). After proper curing of concrete specimen check its compressive, flexural and split tesile strengths by tests. Select an optimum value of percentage of PALF that added to get special concrete.

2 Concept of PALF Rienforced Concrete

Conventional plain concrete is added with specific percentage of PALF by weight of binding material. Which can improve the strength of concrete in cheap cost.

3 Material properties

We used the M20 mix concrete in the ratio 1: 1.5: 3: 0.45 of OPC 53 grade cement: locally available M- Sand: coarse aggregate of nominal size 20 mm: water. Compressive strength of conventional concrete was obtained as 21.19 MPa after 28 days curing. Also used the PALF of aspect ratio 450 collected from a local manufacturer. Which are added in concrete in different percentage by weight of binder material ie, 0.05%, 0.1%, 0.15% and 0.2%.

4 Experimental procedure

The specimens were prepared of $150 \times 150 \times 150$ mm cubes, $100 \times 100 \times 500$ mm beams and cylinders of 150 mm diameter and length of 300 mm by casting in steel moulds. Various mixes were prepared by adding PALF in various ratios. Then poured in moulds and allowed it for 28 days of curing after the demoulding of specimen.

5 Test Results and Discussions

5.1 Effect of PALF on compressive strength of M20 concrete

The test was conducted on $150 \times 150 \times 150$ mm cubes by adding various percentage of PALF which added to the mix. Then tested the each cubes after 28 days of curing. Total 10 cubes were casted. 2 for each percentages of PALF that was added (0%, 0.05%, 0.1%, 0.15% and 0.2%). The test results are shown in table 1. The change in compressive strength according to various percentages is shown in figure 1.

Table 1: Compressive strength of concrete cubes

Percentage of PALF added	Compressive strength (MPa)
0.0%	21.19
0.05%	23.99
0.1%	38.88
0.15%	36.22
0.2%	35.55

The result shows that compressive strength of PALF added concrete increases with increase in percentage of PALF added upto 0.1%, beyond which shows a decrease in compressive strength.

- *Hisana KP and Mohammed Suhail Parathodika are currently pursuing batchler degree program in Civil engineering in APJ Abdul Kalam Technological University, Kerala, India*
- *Ajeesh K: Assistant Professor, MEA Engineering College, Perinthalmanna, Kerala, India, Email: ajeeshk@meaec.edu.in*

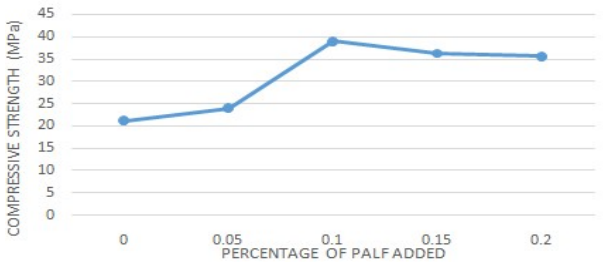

Figure 1: Effect of PALF on compressive strength of concrete

5.2 Effect of PALF on split tensile strength of M20 concrete

The test was conducted on cylinders of 300 mm length and 150 mm diameter by adding various percentage of PALF into mix. 10 cylinders were casted, 2 for each percentage. After curing of 28 days test was conducted on them. The test results are shown in table 2. The change in split tensile strength according to various percentages is shown in figure 2.

Table 2: Split tensile strength of concrete cylinders

Percentage of PALF added	Split tensile strength (MPa)
0.0%	2.96
0.05%	3.60
0.1%	4.45
0.15%	3.53
0.2%	3.53

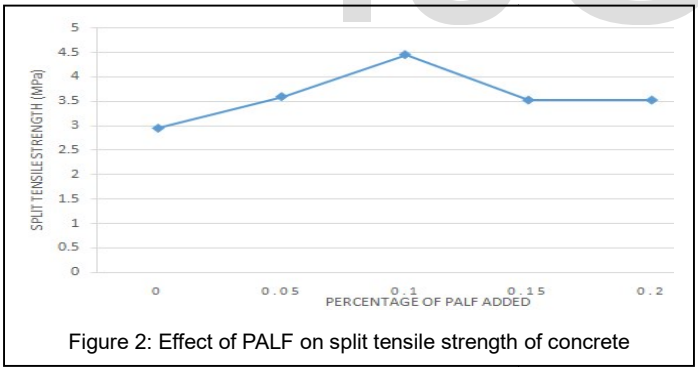

Figure 2: Effect of PALF on split tensile strength of concrete

From the results it was noticed that the split tensile strength of PALF added concrete increases with increase in percentage of PALF added in the mix upto 0.1%, beyond which there is a small decrease in strength.

5.3 Effect of PALF on flexural strength of M20 concrete

The test was conducted on $100 \times 100 \times 500$ mm cuboids by adding various percentage of PALF added into the mix. 2 cuboids were casted for each percentage. And the test was conducted on the specimen after 28 days curing. The test results are shown in table 3. The change in flexural strength according to various percentages is shown in figure 3.

Table 3: Flexural strength of concrete beams

Percentage of PALF added	Split tensile strength (MPa)
0.0%	4.66
0.05%	5.74
0.1%	6.14
0.15%	5.19
0.2%	4.39

From the results it is clearly showed that flexural strength of M20 concrete increases with increase of percentage of PALF added upto 0.1%. Beyond which there is a decrease in flexural strength.

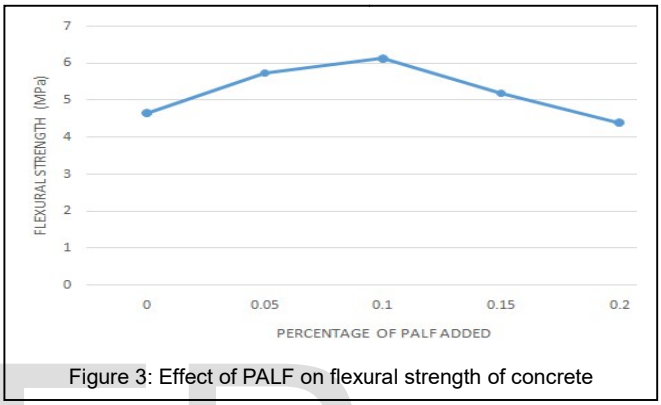

Figure 3: Effect of PALF on flexural strength of concrete

The tables and graphs shows the compressive strength, split tensile strength and flexural strength of PALF added M20 concrete in various percentage by weight of binder material. And there is an improvement in strength with the increase of percentage PALF added upto an optimum level, then there shows a decrease in strengths. It may due to reduction in adhesiveness of PALF with concrete matrix.

6 Conclusion

From the obtained test results it can be concluded that the PALF can effectively used as fiber reinforcement in concrete. The maximum strength attained at 0.1% of PALF by the weight of cement was added into the matrix in the aspect ratio 450.

Acknowledgment

The authors wish to thank all the faculty members of the department of civil engineering, MEA Engineering College Perinthalmanna who were a part of this work.

References

[1] Balasubramanian, J.Chandrashekaran, Dr.S.Senthil Selvan. "Experimental Investigation of Natural Fiber Reinforced Concrete in Construction Industry", *International Research Journal of Engineering and Technology, Volume: 02 Issue: 01*, Apr-2015.

[2] Linto Mathew, Dr. Mathews M. Paul. "Mechanical Properties of Pineapple Fiber Reinforced Concrete Subjected to High Temperature", *GRD Journals- Global*

Research and Development Journal for Engineering, Volume 2, Issue 5.April 2017.

[3] M. Asim, Khalina Abdan, M. Jawaid, M. Nasir, Zahra Dashtizadeh, M. R. Ishak, and M. Enamul Hoque. "A Review on Pineapple Leaves Fibre and Its Composites", *International Journal of Polymer Science*, 2015.

[4] Md. Reazuddin Repon, K. Z. M. Abdul Motaleb, M. Tauhidul Islam, Rajib Al Mamun, Md. Mizanur Rahman Mithu. "Tensile and Water Absorption Properties of Jute and Pineapple Fabric Reinforced Polyester Composite", *International Journal of Composite Materials*, 2017.

[5] Riya Johnson, Amritha E. k. "Experimental Study on Pineapple Leaf Fibre Reinforced RCC Beams", *International Journal of Engineering Research and General Science Volume 6, Issue 3*, May-June, 2018.

[6] R. Roselin, Dr. M.S. Ravikumar. "Experimental Investigation on Pineapple Fibre Reinforced Cement Concrete", *International Journal of Civil Engineering and Technology (IJCIET), Volume 9, Issue 6*, June 2018, pp. 1479–1484.

[7] Santosh Kumar D S, Praveen B A, Kiran Aithal S, U N Kempaiah. "Development of Pineapple Leaf Fiber Reinforced Epoxy Resin Composites", *International Research Journal of Engineering and Technology, Volume: 02 Issue: 03*, June-2015.