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Experimental Investigation on Pine Apple Leaf Fibre Concrete with Copper Slag as Partial Replacement of Fine Aggregate

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ABSTRACT

Building construction plays a crucial role in the world's rapid development, as we are all too aware of. In-depth analysis reveals that as concrete use increases, there is a depletion of natural resources. We considered replacing some of the proportions in order to preserve our natural resources. The study focuses on the compressive strength and split tensile strength tests of blended concrete incorporating varied percentages of copper slag as a partial replacement of fine aggregate and pine apple leaf fiber. Weight of fine aggregate in concrete is substituted with percentages of 0%, 10%, 30%, 40%, and 50%, and pine apple leaf fiber is added to concrete addition in amounts of 0.1%, 0.2%, 0.3%, and 0.4%. Concrete cylinders and cubes are evaluated after 28, 56 and 90 days. The strength performance of slag blended fiber reinforced concrete is then contrasted with that of traditional concrete

Keywords- ***Copper Slag, Pine Apple Leaf Fibre, Compressive strength, Split tensile strength.***

1. INTRODUCTION

The most common and extremely strong construction material is concrete. Cement, coarse aggregates, fine aggregates, and water are the main ingredients of concrete. The substance that connects the coarse aggregates and fine aggregates collectively is concrete. Sand and rock are enclosed by a glue-like gel made of concrete and water. Total coarse aggregates are used as high-quality material. Concrete performs well under pressure but fails under strain. Nowadays we use several sources of admixtures in the solid to avoid these problems. The use of copper slag as a partial replacement for fine total concrete results in a reduction in the amount of concrete used. Pineapple leaf fiber (PALF) is a byproduct that pineapple plants don't want to produce. For industrial usage, PALF is cheap, readily accessible, has a high specific strength, and is plentiful and rigid. In order to reinforce structures, PALF uses

bio-composites. This encourages sustainable development. In concrete reinforcement, a natural fiber known as pineapple leaf fiber (PALF) has the potential to replace synthetic fibers. Concrete that has just been poured will fibrillate, absorb water, and change in terms of its mechanical qualities if PALF is used as a reinforcing fiber.

2. OBJECTIVE

a) To use copper slag in fine aggregate as efficiently as possible.
c) To absorb water and improve the concrete's mechanical qualities by including pineapple leaf fiber.
c) To evaluate the outcomes of the split tensile strength and compressive strength tests.

3. MATERIALS

a. Cement: As an essential part of concrete, mortar, plaster, and the majority of nonspecialty grout, ordinary Portland cement is the type of cement that is most frequently used in construction worldwide. The primary component used in the creation of concrete is cement. Changing the cement content will have a significant impact on the properties of concrete. In accordance with IS 12269-2013, the cement utilized in this project is ordinary Portland cement of grade 53.

b. Fine Aggregate: Fine aggregate is the most crucial component of concrete made using natural sand or crushed stone. The qualities of the cured concrete are substantially influenced by the density and quality of the fine aggregate.

c. Coarse Aggregate: The coarse material used had a maximum size of 20 mm and a minimum size of 12.5 mm. It was easily accessible locally. After being washed to remove dust and grime, the aggregates were dried until they were only damp on the surface. The aggregates were found to be compliant with IS: 383-1970.

d. Water: One of the most crucial materials in construction, water is needed for a variety of tasks like making mortar, mixing cement concrete, and curing work. The strength of the motor and cement concrete in the construction project is directly influenced by the quality of the water utilized.

e. Copper slag: Concrete can be made using copper slag in place of some of the sand. Copper slag is shaped into blocks and used as a building material. Such use was widespread in places where smelting took place, such as Cornwall and St Helens in England. Fumed and settled granulated copper slag from the Boliden copper smelter is used as road construction material in Sweden (Skellefte region).

f. Pine Apple Leaf Fibre: Pineapple leaf fiber composite has a tremendous impact on bio composites and material science. Due to its reasonable and infinite nature, PALF has shown to be a good substitute for artificial filaments. The outermost layer of the leaves is separated from the leaf fibers to create the fibers, which are then dried.

4. RESULTS

A. Compressive Strength: The measurement of concrete's compressive strength is crucial since it serves as a benchmark for the material's quality. Compressive strength is the standard unit of measurement for other strength. In N/mm2, the strength is measured.

Table 1: Compressive Strength Results on Concrete by Partial Replacement of Copper Slag in Fine Aggregate.

S.No	% Of Copper Slag	Compressive Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	39.15	42.48	45.73
2	10%	41.06	44.57	47.99
3	20%	42.34	46.02	49.51
4	30%	43.84	47.65	51.27
5	40%	45.72	49.78	53.47
6	50%	41.53	45.16	48.56

Table 2: Compressive strength result by addition of Pine Apple Leaf Fibre in concrete

S.No	% Pine Apple Leaf Fibre	Compressive Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	39.15	42.48	45.73
2	0.1%	41.45	44.99	48.42
3	0.2%	42.84	46.51	50.07
4	0.3 %	45.38	49.34	53.10
5	0.4%	41.51	45.25	48.56

Table3: Compressive Strength of concrete for combined partial replacement of Fine Aggregate by 40% Copper Slag+ 0.3% Pine Apple Leaf Fibre.

S.No	Combined replacements (%)	Compressive Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0	39.15	42.48	45.73
2	40%CS+0.3%PALF	48.72	53.02	56.94

B. Split tensile Strength: At ages 28,56 and 90 days, the cylindrical specimens (150 mm in diameter x 300 mm in height) were inspected to determine the split tensile strength. A load is applied to a cylindrical sample that is positioned horizontally between the loading surface of a compression testing equipment until the cylinder fails along its vertical diameter.

Table 4: Split tensile Strength Results on Concrete by Partial Replacement of Copper Slag in Fine Aggregate.

S.No	% Of Copper Slag	Split tensile Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	3.84	4.15	4.48
2	10%	4.06	4.42	4.74
3	20%	4.18	4.56	4.88
4	30%	4.38	4.78	5.12
5	40%	4.66	5.06	5.44
6	50%	4.13	4.49	4.83

Table 5: Split tensile Result by addition of Pine Apple Leaf Fibre in concrete

S.No	% Pine Apple Leaf Fibre	Split tensile Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0%	3.84	4.15	4.48
2	0.1%	4.08	4.42	4.76
3	0.2%	4.23	4.59	4.92
4	0.3 %	4.51	4.96	5.27
5	0.4%	4.12	4.45	4.81

Table6 : Split tensile Strength of concrete for combined partial replacement of Fine Aggregate by 40% Copper Slag+ 0.3% Pine Apple Leaf Fibre.

S.No	Combined replacements (%)	Split tensile Strength Results, N/mm^2		
		28 days	56 days	90 days
1	0	3.84	4.15	4.48
2	40%CS+0.3%PALF	4.89	5.31	5.76

5. CONCLUSIONS

1. The Normal Concrete of Compressive Strength results for 28,56 and 90 days is 39.15 N/mm^2, 42.48 N/mm^2 and 45.73 N/mm^2.
2. The Normal Concrete of Split tensile Strength results is for 28,56 and 90 days is 3.84 N/mm^2, 4.15 N/mm^2 and 4.48 N/mm^2.
3. At 40% partial replacement of Copper Slag with Fine Aggregate the Compressive Strength results for 28,56 and 90 days is 45.72 N/mm^2, 49.78 N/mm^2 and 53.47 N/mm^2.

4. At 40% partial replacement of Copper Slag with Fine Aggregate the Split tensile Strength results for 28,56 and 90 days is 4.66 N/mm^2, 5.06 N/mm^2 and 5.44N/mm^2.
5. By addition of 0.3% Pine Apple Leaf Fibre in concrete the Compressive Strength results for 28,56 and 90 days is 45.38 N/mm^2, 49.34 N/mm^2 and 53.10 N/mm^2.
6. By addition of 0.3% Pine Apple Leaf Fibre in concrete the Split tensile Strength results for 28,56 and 90 days is 4.51 N/mm^2, 4.96 N/mm^2 and 5.27 N/mm^2.
7. By the combination of 40% partial replacement of Copper Slag with Fine Aggregate +By adding 0.3% Pine Apple Leaf Fibre in Concrete the Compressive Strength results for 28,56 and 90 days is 48.72 N/mm^2, 53.02 N/mm^2 and 56.94 N/mm^2.
8. By the combination of 40% partial replacement of Copper Slag with Fine Aggregate +By adding 0.3% Pine Apple Leaf Fibre in Concrete the Split tensile Strength results for 28,56 and 90 days is 4.89 N/mm^2, 5.31 N/mm^2 and 5.76N/mm^2.

REFERENCES

[1] Yadlapalliadilakshmi1,j.sreenagachaitanya 2, EXPERIMENTAL INVESTIGATION ON RECRON3S FIBER REINFORCED CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT WITH METAKAOLIN AND FINE AGGREGATE WITH COPPER SLAG,The International journal of analytical and experimental modal analysis Volume XII, Issue VII, July/2020 ISSN NO:0886-93672.

[2] Hisana KP, Parathodika MS, Ajeesh K (2019) Experimental study on pineapple leaf fiber reinforced RCC beams. Int J Eng Res Gen Sci 6(3):2018–2020.

[3] J.Sree Naga Chaitanya, Dr.K.Chandramouli, Sk.Sahera, G. SaiTeja Reddy. An Experimental Investigation On Pineapple Leaf Fibre Concrete By Using Zeolite Powder And Dunite Powder As Partial Replacement Cement, International Journal of Creative Research Thoughts,11(6),(2023), d186-d189.

[4] Akihiko, Y., and Takashi, Y. Study of Utilisation of Copper Slag As Fine Aggregate for Concrete (in Japanese). Ashikaya Kogyo Daigaku Kenkyu Shuroku; 23:79-85, 1996.

[5] Siti Khadijah Che Osmi, Mohamad Asrul Zaınuddın, Noor Aina Misnon, Suriyadi Sojipto, and Hapsa Husen, Effect of Pineapple Leaf Fibre as Additional Material in Concrete Mixture,August-2022.

[6] G. Hymavathi, Dr.K. Chandramouli, J. Sree Naga Chaitanya, M.Chaitanya Nava Kumar, V.V.Raghavendra Gupta, Investigation On Bendable Concrete, International Journal of Research Publication and Reviews,3(7),(2022), 1513 1516.

[7] J. Sree Naga Chaitanya , Dr. K. Chandramouli , Dr. Sk. Bifathima , A. Pavani. Investigation on Concrete with M-Sand and Silica Fume, International Journal for Multidisciplinary Research,4(4),(2022),671-675.

[8] Tamil Selvi P, Lakshmi Narayani P and Ramya G, "Experimental study on concrete using copper slag as replacementmaterial of fine aggregate", Vol. 4, Issue-5, 1000156, PP. 1-6.

[9] **J.Sree** Naga Chaitanya, Dr.K.Chandramouli, Sk.Sahera, G. Sai Teja Reddy. Mechanical Properties on Pineapple Leaf Fibre Concrete by Using Dunite Powder and Zeolite Powder As Partial Replacement Cement, International Journal of Engineering and Science Invention, 12(7),(2023), 64-68.

[10] **D**r.K.Chandramouli, J.Sree Naga Chaitanya, Dr.N.Pannirselvam,A. Murali Krishna. Ultra High Strength Concrete by Using Alccofine (1203),9(8),(2021),b41-b44.