International Journal of Advanced Science and Technology
Vol. 29, No. 08, (2020), pp. 2020- 2032

Experimental Study On Ferrocement With Coir Fibers

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Abstract
Ferrocement is comprised of a blend of concrete mortar and single or various layers work which are firmly separated. It is generally utilized because of its favorable position from its a portion of the conduct, for example, mechanical properties and effect quality. The fundamental point of this task is to explore or consider the quality attributes of Ferro-concrete with and without utilizing coir fiber. By differing the level of fiber included (1%, 2% and 3% of concrete). Likewise contrast the quality of Ferro-concrete and single and twofold layer of square wire work.The mechanical test was performed to check the impact of fibers on improving compressive, flexural and split tensile in Ferro-cement. Since fiber go about as optional fortification, it will keep Ferrocement from small scale splitting and engendering break development and builds the quality. After the expansion of coir strands into ferrocement expands the flexural and spilt elasticity consequently it very well may be utilized more as flexural part in development.

Keywords: *Ferrocement, Coir fiber, Compressive strength, flexural strength, split tensile*

1.0 Introduction

1.1 General

Ferrocement is a mix material comprising of concrete sand lattice strengthened with layers of little measurement wire networks. It contains of firmly dispersed, a few layers of work or well poles totally encompassed in concrete mortar. Generally steel bars are utilized in including, to frame a steel skeleton, which helps in retentive the necessary state of the ferrocement parts till the concrete mortar solidifies. Normally the wire work fortification will be routinely dispersed over the thickness of the part. Since Ferrocement have certain special properties, for example, high rigidity to weight proportion, prevalent splitting conduct, lightweight, form capacity to any shape.

1.2 Coir Fiber

They are the rural waste products acquired inside the processing of coconut oil, and are to be had in Coconut fiber has been used to enhance concrete and mortar, and has demonstrated to enhance the toughness of the concrete and mortar. However, the hassle of long time sturdiness has not but been solved. It has also been noticed that the degree of enhancement of concrete via coconut fibers depended on the sort of coconut species and the sub-location that the coconut plant became cultivated.

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2.0 Materials and Methodology

2.1 Materials Used

1. Cement
2. M-sand
3. Water
4. Wire mesh
5. Coir fibers

2.2 Compressive Strength of Mortar

- 3 days Compressive strength = 28.2 N/mm2 (not less than 27N/mm2)
- 7 days Compressive strength =37.4 N/mm2 (not less than 37 N/mm2)
- 28 days Compressive strength =55.7 N/mm2 (not less than 53 N/mm2)

2.3 Quantity of materials required for casting of specimens

Table 2.1: Quantity of materials required for casting of six cubes

Percentage of fibers	Fiber content in gms	Cement in kg	Fine aggregate in kg	Water content in litres
0%	0	11.22	33.66	5.04
1%	110	11.22	33.66	5.04
2%	220	11.22	33.66	5.04
3%	330	11.22	33.66	5.04

Table 2.2: Quantity of materials required for casting of six beams

Percentage of fibers	Fiber content in gms	Cement in kg	Fine aggregate in kg	Water content in litres
0%	0	16.2	48.6	7.29
1%	54	16.2	48.6	7.29
2%	108	16.2	48.6	7.29
3%	162	16.2	48.6	7.29

Table 2.3: Quantity of materials required for casting of six cylinders

Percentage of fibers	Fiber content in gms	Cement in kg	Fine aggregate in kg	Water content in litres
0%	0	17.52	52.56	7.884
1%	175	17.52	52.56	7.884
2%	350	17.52	52.56	7.884

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3%	525	17.52	52.56	7.884

2.4. Mixing of Materials

Mortar is mixed both by using hand or machine blending. Fig 2.1 shows the hand mixing strategy. Mortar is a blend of Cement, Water and high-quality aggregates.

Figure 2.1: Mixing of mortar

2.5Preparation of Mould

With 0 layers of work in it was first casted in three equivalent layers of mortar with appropriate compaction. For 1 layer of work concrete mortar is laid for half of the thickness after that work was set over the completed and compacted mortar, and equalization half layer is laid with acceptable compaction, and top surface wrapped up. Comparative procedure of laying for 2 layer work was finished.

Figure2.2: Preparation of moulds

Figure2.3: Moulds placed in water bath

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2.6 Casting of Ferrocement Moulds with Coir Fibers

The measures of fiber are 1%, 2% & 3% of Cement. Fiber strands are in length of 5centimetre are dried in daytime for twenty-four hours.At that point it is put in the shape, as same as early ferrocement throwing and place the wire work at that point compacted and completed is appeared in Fig. 2.4 Six Cubes every one of the equivalent are arranged and cured. The moulds are cured for 7day, 14days and 28 days of curing.

Figure 2.4: Mixing of coir fibers with mortar

2.7 Testing of Specimens

2.7.1 Testing of Cube Specimens for Compressive Strength

Compressive strength is the ability of material to face as much as axial loads tending to lessen the size.

Figure 2.5: Compressive testing machine

2.7.2Testing of Beam Specimens for Flexural Strength

Flexural strength of ferrocement is considered as an sign of tensile strength of ferrocement.

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Figure 2.6: Universal testing machine

2.7.3 Testing of Cylinder Specimens for Split Tensile Strength

Tensile strength is the potential of a material or structure to withstand tensile force.

Figure 2.7: Spilt tensile testing

3.0 Analysis and Results

3.1 Compressive Strength of Conventional Ferrocement

Ferrocement cubes of size 150mm*150mm have been casted for the mix proportion of cement and sand ratio is 1:3 and w/c ratio of 0.45. the compressive strength of Ferrocement cubes of single and double layers are tested in compressive testing machine at different days of curing(7days, 14days, 28days) are shown in table 3.1

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Table 3.1: Compressive strength of conventional ferrocement cubes

Number of Layers	Compressive strength in N/mm^2		
	7 days	14 days	28 days
1	15.15	22.04	23.42
2	19.34	26.53	29.73

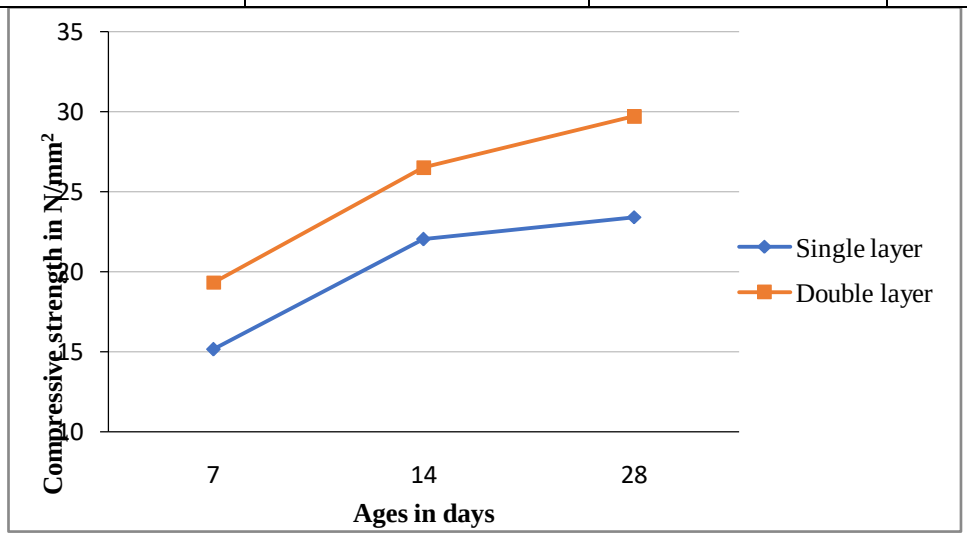

Figure 3.1: Graph shows varying compressive strength at different days of curing for conventionalferrocement

From the above table 3.1 and figure: 3.1 it has been observed that the compressive strength of double layer is more than the single layers by 26.94%. So we say that the compressive strength of ferrocement is increases on increasing number of layers in it.

3.1.1 Compressive Strength ofFerrocementwith Coir Fibers

Coir fibers are added with varying proportion (1%, 2%, 3% of cement weight) with w/c ratio of 0.45 for single layer and double layer of wire mesh, the results of compressive strength of ferrocement cubes are shown in table 3.2 and shown graphically in fig: 3.2 and fig: 3.3.

Table 3.2: Compressive strength of ferrocement with coir fibers

Number of layers	ercentage (%)	Compressive Strength in N/mm^2		
		7 days	14 days	28 days
1	1	15.50	23.87	25.42
	2	14.92	21.65	24.07
	3	14.74	21.29	23.40
2	1	20.10	28.63	32.17
	2	18.47	27.40	30.11

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	3	17.63	26.51	29.46

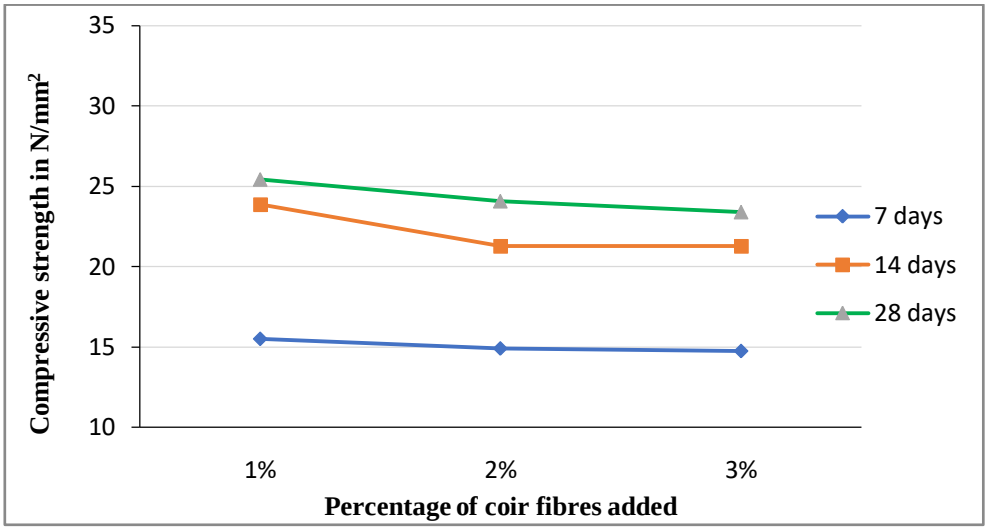

Figure 3.2: Compressive strength of ferrocement single layer with coir fibers

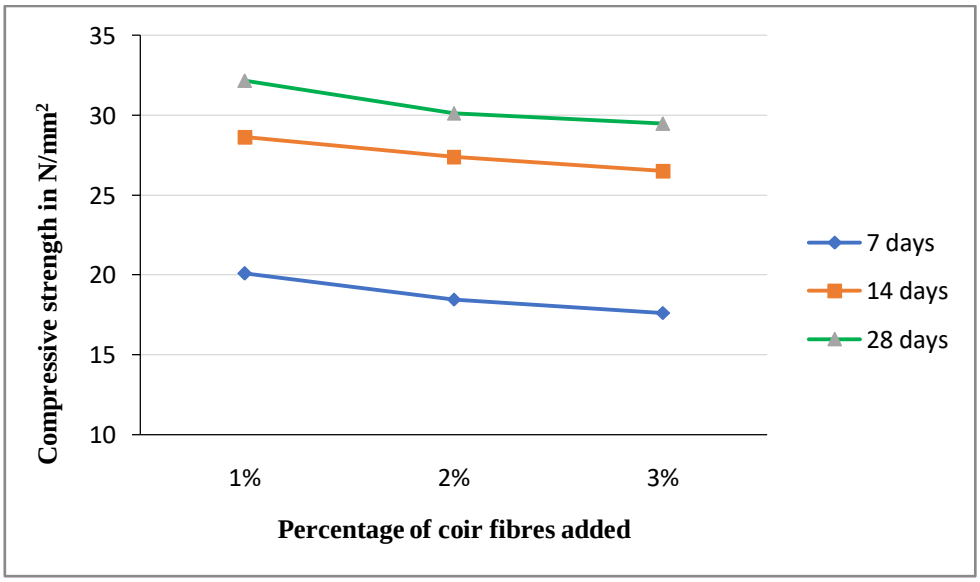

Figure 3.3: Compressive strength of ferrocement double layers with coir fibers

From the table 3.2 the values of compressive strength of ferrocement with coir fibers is gradually decreases on increasing the percentage of coir fibers added to it. Because on increasing fiber content resistance against compression decreases.

3.2 Analysis of Flexural Strength

Flexural strength test have been performed on popular beams of size 100mm×100mm×150mm are castedfor both single and double layer mesh ,with mix proportion of 1:3 and water cement ratio of .55.Those are tested in UTM machine with single point load at 7, 14 and 28 days.

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3.2.1 Flexural Strength of Conventional Ferrocement

Totally 12 moulds are casted and test results of flexural strength of conventional ferrocement of single and double layers are shown in table: 3.3 and shown graphically in fig: 3.4.

Table 3.3: Flexural strength of conventional ferrocement beams

Number of layers	Flexural strength in N/mm^2		
	7 days	14 days	28 days
1	6.2	9.75	12.3
2	10.85	11.23	13.05

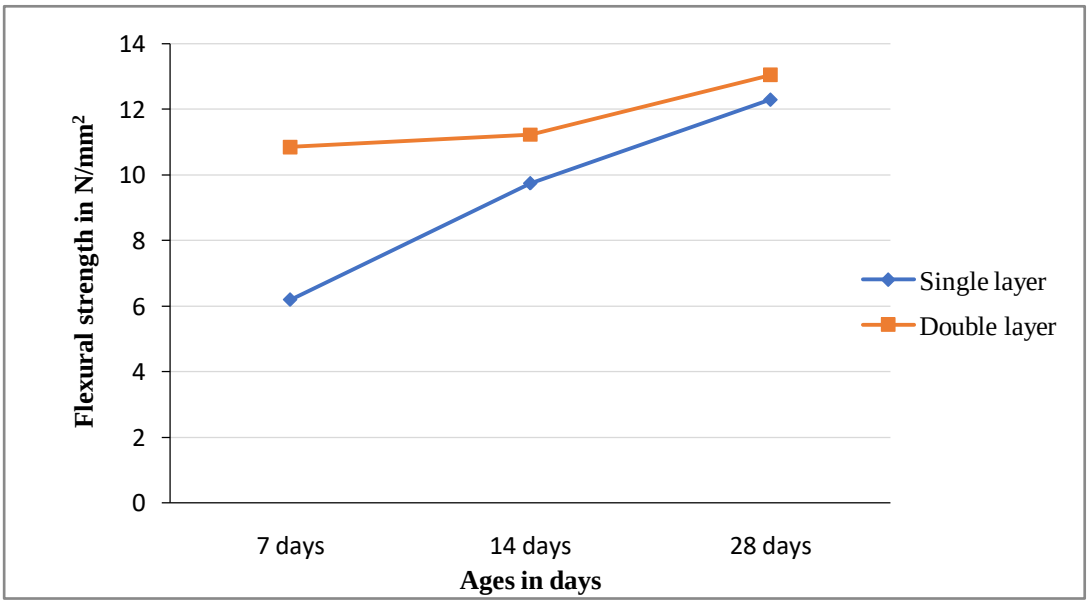

Figure 3.4: Flexural strength of conventional ferrocement

From the table 3.3 it has been observed the average flexural strength achieved in 7, 14 days are 61.85% and 87.75% of 28days strength respectively. The flexural strength increases on increasing number of layers**.**

3.2.2 Flexural Strength of Ferrocementwith Coir Fibers

The beam moulds for flexural strength of ferrocement by adding varying percentage (1%, 2%and 3%) of coir fibers were casted and are tested in 7,14 and 28 days. The results are summarised in Table: 3.4 and graphically represented in Fig: 3.5 and Fig: 3.6

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Table 3.4: Flexural strength of ferrocement with coir fibers

Number of layers	Percentage (%)	Compressive Strength in N/mm^2		
		7 days	14 days	28 days
1	1	8.34	12.52	13.91
	2	8.54	12.80	14.23
	3	8.47	12.70	14.12
2	1	8.82	13.23	14.7
	2	9.66	14.51	16.1
	3	9.56	14.34	15.94

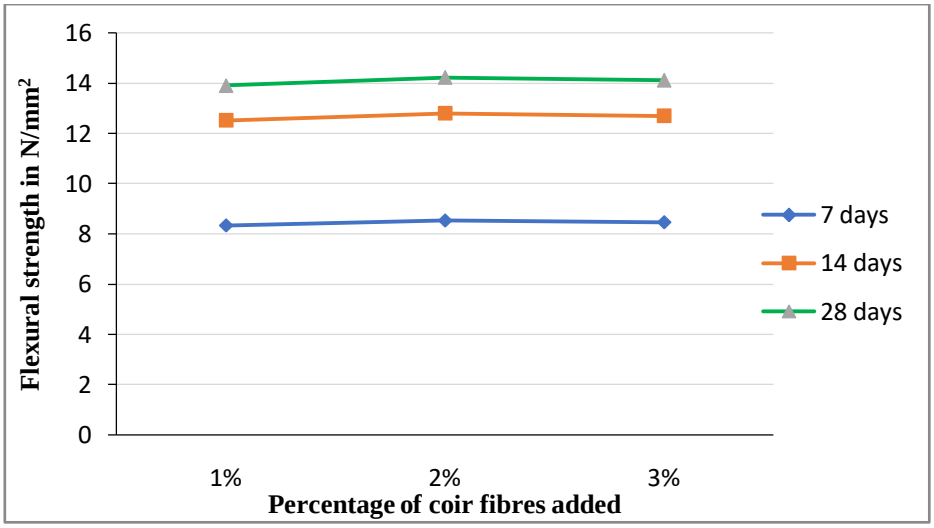

Figure 3.5: Flexural strength of ferrocement single layers with coir fibres

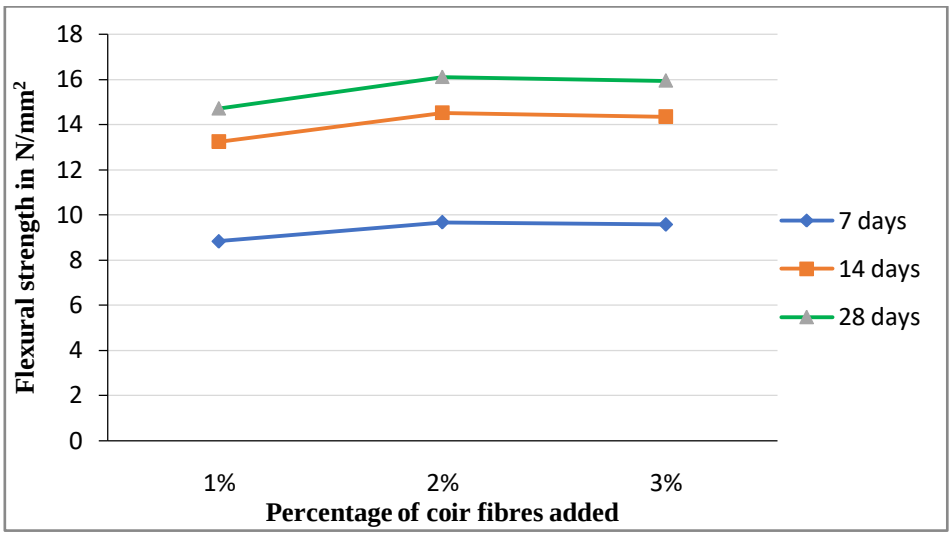

Figure 3.6: Flexural strength of ferrocement double layers with coir fibres

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From the graph it's been visible that after fiber content material will increase there's an increasing in flexural strength with a most at 2 percent of fiber. However while the fiber content material is multiplied past this value a downward slope of graph is determined.

3.3 Analysis of Split Tensile Strength

Spilt tensile strength test had been carried out on popular cylinders of measurement 150mm diameter and height 300mm are casted in single and double layers of wire mesh with mix proportion of 1:3 and w/c ratio of 0.45.Theresults are obtained for 7, 14 and 28 days of curing by loading under compression testing machine.

3.3.1 Split Tensile Strength of Conventional Ferrocement

Totally 12 moulds are casted for the conventional ferrocement tests and are tested in 7, 14 and 28 days. The test results are summarised in Table: 3.5 and variation spilt tensile strength are shown graphically in fig: 3.7

Table 3.5: Split tensile strength of conventional Ferrocement cylinders

Number of layers	Split tensile strength in N/mm^2		
	7 days	14 days	28 days
1	1.72	2.74	2.98
2	1.95	2.81	3.10

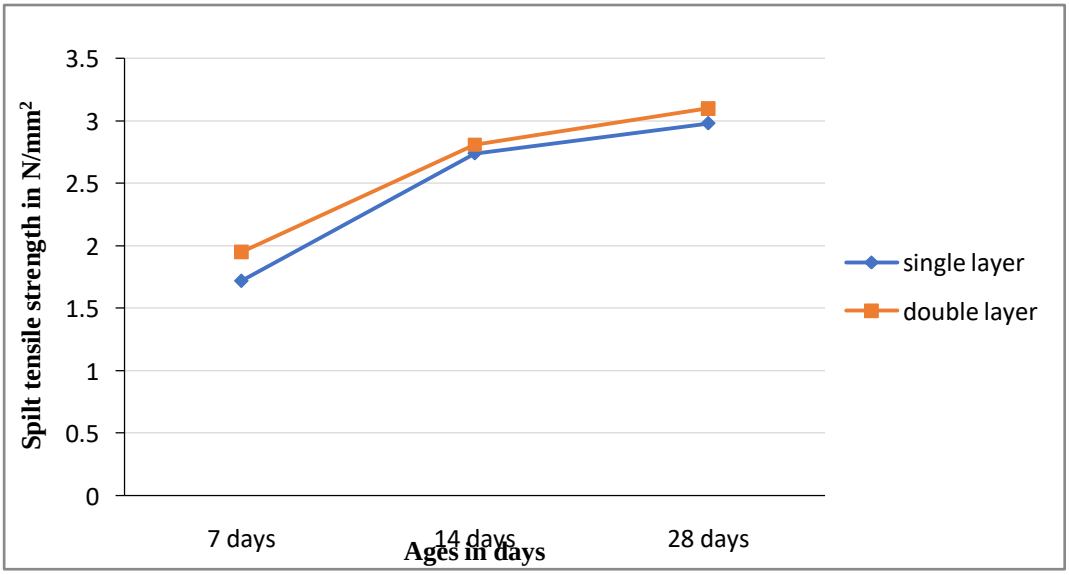

Figure 3.7: Split tensile strength of conventional ferrocement

From the table 3.7 it has been observed the average spilt tensile strength achieved in 7, 14 days are 60.33% and 91.24% of 28days strength respectively. The spit tensile strength increases on increasing number of layers.

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3.3.2 Split Tensile Strength of Ferrocement with Coir Fibers

The cylinder moulds for Spilt tensile strength of Ferrocement by adding varying percentage (1%, 2%and 3%) of coir fibers are casted and are tested in 7,14 and 28 days. The results are summarised in Table: 3.6 and graphically represented in fig:3.8 and fig: 3.9

Table 3.6: Split tensile strength of ferrocement with coir fibers

Number of Layers	Percentage (%)	Split tensile Strength in N/mm^2		
		7 days	14 days	28 days
1	1	2.86	4.09	4.50
	2	3.82	5.60	6.23
	3	3.88	5.41	5.98
2	1	4.32	6.10	6.86
	2	5.34	7.72	8.62
	3	5.31	7.60	8.54

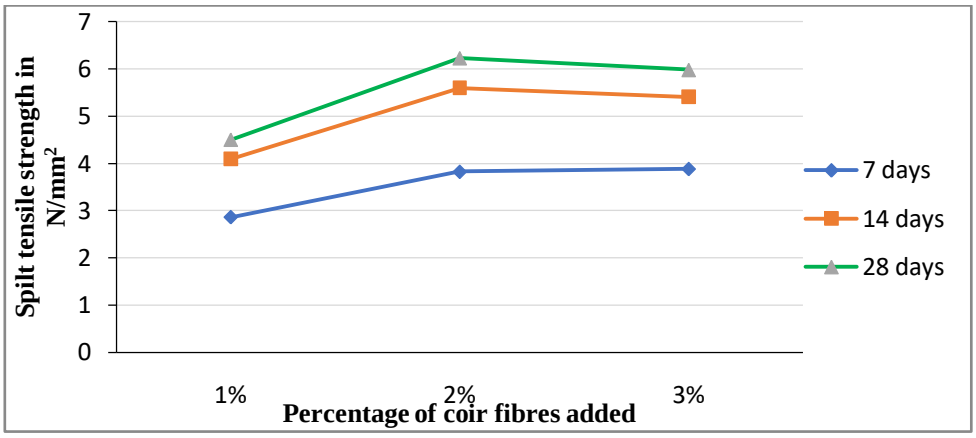

Figure 3.8: Split tensile strength of ferrocement single layer with coir fibers

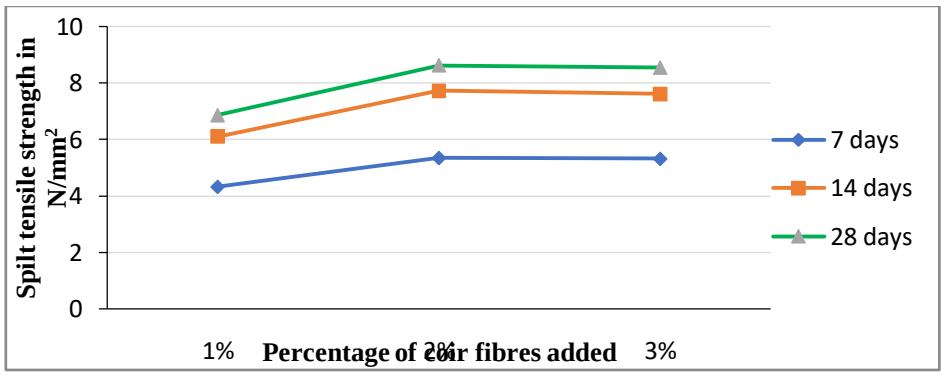

Figure 3.9: Split tensile strength of ferrocement double layer with coir fibers

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From the graph it's been visible that after fiber content increases there may be an increasing in spilt tensile strength with a most at 2 percent of fiber.

4.0 Conclusion

Based on experimental work following conclusion are made:

1) Compressive strength of ferrocement increases on increasing number layer, it has been observed that the compressive strength of double layer is more than the single layers by 26.94%.
2) Compressive strength of ferrocement with introduction coir fibres gradually decreases, it has seen in both single and double layer of wire mesh.
3) Flexural strength of ferrocement increases on increasing number of layers, it has been observed that the flexural strength of double layer is more than that of single layer by 6.09%.
4) Flexural strength has been seen that when fiber content increases there may be an increasing in flexural strength with a most at 2 percent of fiber.
5) The split tensile strength increases on increasing number of layers, it shows that split tensile strength of double layer is 4.09% more than single layer.
6) The spilt tensile strength has been visible that after fiber content will increase there may be an increasing in spilt tensile strength with a most at 2 percent of fiber.

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