INFLUENCE OF MINERAL ADMIXTURES IN CEMENT CONCRETE TO DEVELOP LIGHT WEIGHT STRUCTURES

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Abstract—. **Concrete is second most important consumption in the world. Commonly concrete is composed with cement and fine aggregates and coarse aggregates.. In this study, We found that aluminium powder and betel nut fibre can be used as substitutes for cement and coarse aggregates in a strong concrete mix that is combined in a 1:3 ratio. We deduced from the aforementioned experimental checks and results that the best alternative to cement was concrete built with 0%, 0.25%, 0.50%, 0.75%, and 1.0% Aluminium Powder and 0.25%, 0.50% Betel Nut Fibre as additions. The Compressive Strength of Concrete Mixing of M1 to M5 For 0.25% of Betel Nut Fiber for 7,14, and 28 Days of Curing, In Which M3 Concrte Mix gives the Optiumum Percentage of 0.25% Betel Nut Fiber. And the compressive strength of Concrete Mixing of M6 to M10 For 0.5% of Betel Nut Fiber for 7,14, and 28 Days of Curing, In Which M8 Concrte Mix gives the Optiumum Percentage of 0.5% Betel Nut Fiber.**

Keywords— Aluminium powder, Optimum %,Betel nut fiber etc..,

I. INTRODUCTION

One of the most important components of construction materials is concrete. The concrete building industries are growing rapidly today. There has been an increase in demand for building structures, infrastructure, and airports globally in recent years. The development of lightweight concrete in the building industry has helped to solve various issues caused by the large dead load of conventional concrete. By boosting the mix volume and lowering the structure's dead load, lightweight concrete acts as an intensifying agent. Lightweight concrete has a lower weight than traditional concrete.

1.1 Cement

In this paper we have used cement OPC 43 Grade (Ultratech cement).

1.2 Fine aggregates

Fine aggregate is used 4.75 mm Indian standers sieve passed M-sand is used in the preparation of specimen.

1.3 Aluminium powder

Light-weight aerated concrete is produced by making LAC involves the addition of the gas-forming admixture like aluminium powder to a wet mortor mixture.

Fig ; 1 Aluminium powder

1.4 AGRO WSTE BETEL NUT(ARECA CATECHU)

Due to different amounts of cellulose, hemicellulose, lign, and moisture, it was discovered that the maturity of the BNH fibre influences its thermal stability. The BNH fibres' length and diameter decreased and their density rose as the maturity of the fibre increased.

Fig 2 Agro Waste Betel Nut

II. MATERIALS AND METHODOLOGY

2.1 MATERIALS

In this project, M-43 Grade concrete is given; the proportions for mixing are determined by the M-43 Grade mix design. This experimental investigation makes use of the materials listed. Binding materials

- Cement
- Aluminium powder
- Fine Aggregate
- Agro wste betel nut(areca catechu)

2.2 METHODOLOGY

2.2.1 The construction process uses the following protocol.

FLOW CHART

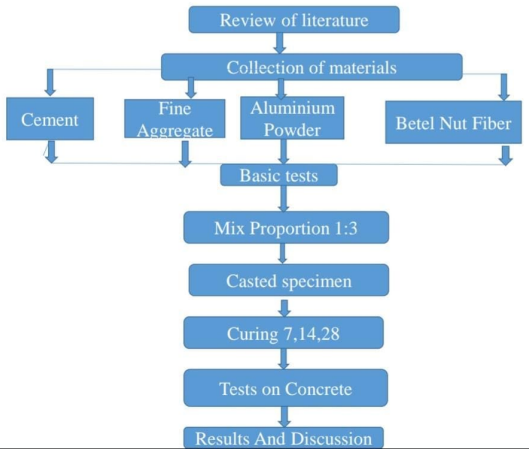


Fig 3 flow chart

2.3 Experimental studies

2.3.1 Mixing scheme

For this test, we used concrete of grade M-43. The blend layout is successfully completed as being consistent.

Table 1: Betel Nut Fiber @0.25 Percent Used

Sl.No	Mix Propotion @ Aluminium Powder	Mix Propotion @ Betel Nut Fiber
M_1	0%	0.25
M_2	0.25	0.25
M_3	0.50	0.25
M_4	0.75	0.25
M_5	1.0	0.25

Table 2: Betel Nut Fiber @ 0.5 Percent Used

Sl.No	Mix propotion @ aluminium powder	Mix propotion @ Betel nut fiber
M_6	0%	0.50
M_7	0.25	0.50
M_8	0.50	0.50
M_9	0.75	0.50
M_{10}	1.0	0.50

2.3.2 Mixing of Concrete:

Cement, sand, aluminium powder, rice husk ash, and betel nuts are precisely weighed before being dry-mixed to achieve a uniform tint. Before adding to the mixture, proper additive and cement mixing has been ensured. Once the ingredients have been dispersed evenly, the mix can be used. Water was added to the mixture, and thorough mixing was made.

Fig 3 Mixing of Concrete

2.3.3Casting of Specimens

The steam can only reach a maximum temperature of 72°C, and it can cure in regular quatar for 14 days. The specimen is then taken out of the water, dried for 24 hours, and cleaned (to remove surface moisture).11 to 14 hours of steam curing are spent at a proper humidity level of about 90%.Concrete can be preserved against moisture loss necessary for hydration and maintained within the specified temperature range via curing. A curing procedure entails keeping the concrete damp or moist until the concrete has fully hydrated and reached its strength.

Fig 4 Curing of Concrete (Moulds)

2.3.4 Specimen testing

The well-known checking out machine (UTM) exanimates the cubes after the last touch of a specific amount of curing time.

Fig 5 Testing machine

RESULTS AND DISCUSSION

3.1 TEST ON FRESH CONCRETE
3.1.1 Slump Cone Test
3.1.2 Vee Bee Consistometer
3.1.3 Compaction Factor

3.1.1 Slump Cone Test:

Table 3: Slump cone test reading

Degree of Workability	Slump(mm)
Very low	0.25mm
Low	25-50mm
Medium	50-100mm
High	100-175
Very high	collapsed

3.1.2 Vee Bee Consistometer Test

Table 4: Vee-Bee test reading

Description	Vee Bee Seconds
Extreme Dry	32-18
Very Stiff	18-10
Stiff	10-5
Stiff Plastic	5-3
Pastic	3-0

3.1.3 Compaction Factor Test

Table 5: Compaction Factor Test

Workability	Compacting Factor	Slump (mm)
Very Low	0.78	0-25
Low	0.85	25-50
Medium	0.92	50-100
High	0.95	100-175

TESTS ON FRESH CONCRETE

1. Slump cone test
2. Compaction factor test
3. Vee-bee consistometer test

1. Slump cone test

Table 5: Slump cone test results

% Replacement of Aluminum powder	Slump value in mm
0%	15
0.25%	13
0.50%	12
0.75%	10
1.0%	9

2. Compaction factor test

Table 6: Compaction factor test results

% Replacement of Aluminum powder	Compaction factor test
0%	0.754
0.25%	0.741
0.50%	0.735
0.75%	0.731
1.0%	0.700

3. Vee-Bee consistometer

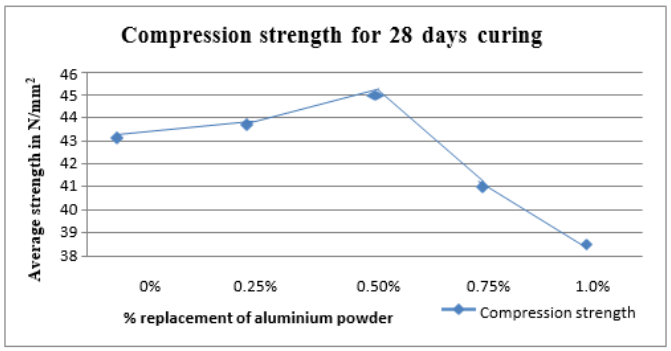
Table 7: Vee – Bee consistometer test results

% Replacement of Aluminum powder	Vee bee degree in seconds
0%	35
0.25%	38
0.50%	40
0.75%	44
1.0%	47

TESTS ON HARDEN CONCRETE

Table 12: Compression test for 28 days of curing @ 0.25 Betel Nut Fiber

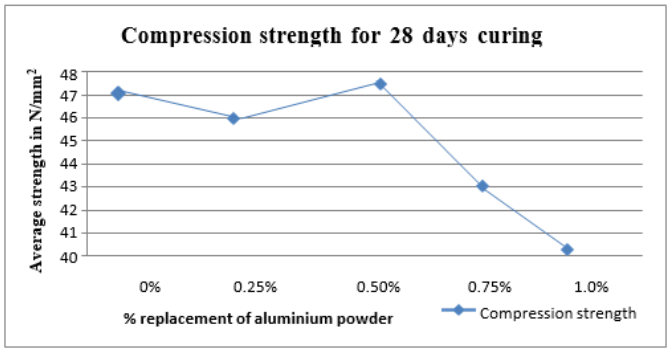
Sl No.	% Replacement of Aluminum powder	Load in kN	Compression strength in N/mm2	Average strength in N/mm²
M_1	0%	1000	44.44	43.99
		1010	44.88	
		960	42.66	
M_2	0.25%	980	43.55	43.18
		970	43.11	
		965	42.88	
M_3	0.5%	1020	45.33	45.7
		1030	45.77	
		1035	46.0	
M_4	0.75%	900	40.0	41.11
		950	42.22	
		925	41.11	
M_5	1%	850	37.77	38.29
		860	38.22	
		875	38.88	



Graph 5: Graphical representation of compression strength test for 28 days of curing

Table 13: Compression test for 28 days of curing @ 0.50 Betel Nut Fiber

Sl No.	% Replacement of Aluminum powder	Load in kN	Compression strength in N/mm2	Average strength in N/mm²
M_6	0%	1045	46.44	47.18
		1060	47.11	
		1080	48.0	
M_7	0.25%	1040	46.22	46.0
		1035	46.0	
		1020	45.33	
M_8	0.5%	1080	48.0	47.77
		1075	47.77	
		1070	47.55	
M_9	0.75%	950	42.22	42.0
		935	41.55	
		930	41.33	
M_{10}	1%	900	40.0	40.0
		910	40.44	
		890	39.55	



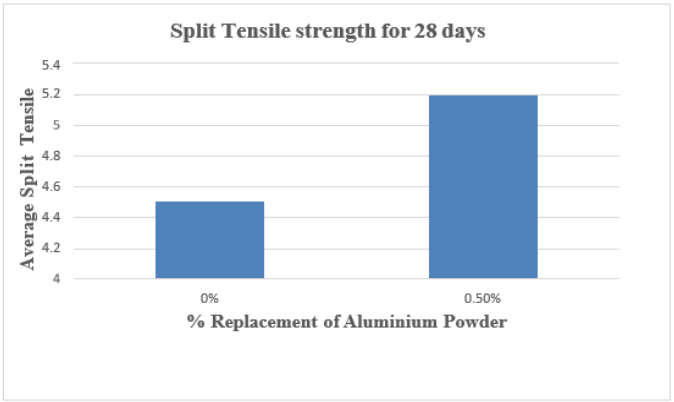
Graph 6: Graphical representation of compression strength test for 28 days of curing

TEST ON SPLIT TENSILE STRENGTH

Graph 9: Graphical representation of split tensile strength

Table 18: split tensile strength test for 28 days of curing @ 0.25 Betel Nut Fiber

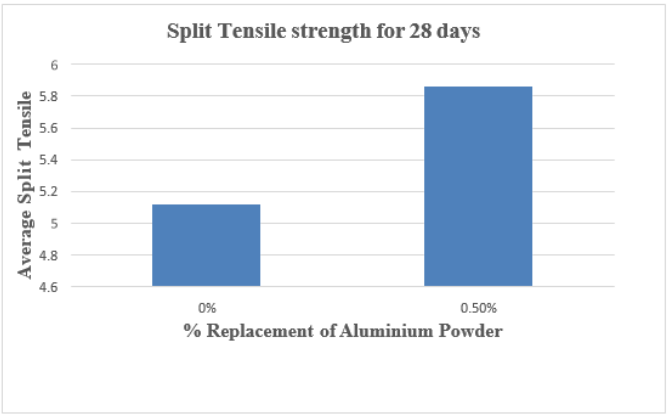
Sl no.	Concrete Mix	Load (KN)	Split tensile Strength(N/mm2)	Average Strength in N/mm2
1	M1	198	3.98	4.50
		190	3.00	
		210	3.12	
2	M3	269	3.56	5.20
		272	3.12	
		282	3.19	



Graph 11: Graphical representation of split tensile strength

Table 19: split tensile strength test for 28 days of curing @ 0.50 Betel Nut Fiber

Sl no.	Concrete Mix	Load (KN)	Split tensile Strength(N/mm2)	Average Strength in N/mm2
1	M1	223	3.98	5.12
		230	4.00	
		350	4.12	
2	M7	369	4.56	5.86
		372	4.12	
		382	4.19	

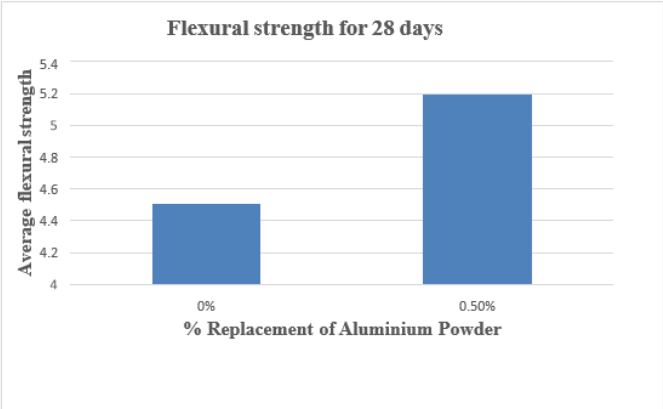


Graph 12: Graphical representation of split tensile strength

TEST ON FLEXURAL STRENGTH

Table 22: flexural strength test for 28 days of curing @ 0.25 Betel Nut Fiber

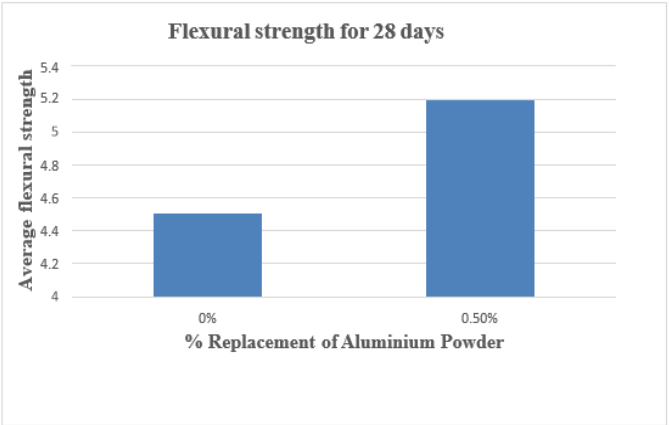
Sl no.	Concrete Mix	Load (KN)	Flexural Strength(N/mm2)	Average Strength in N/mm2
1	M1	198	3.98	4.2
		190	3.00	
		210	3.12	
2	M3	269	3.56	5.45
		272	3.12	
		282	3.19	



Graph 15: Graphical representation of flexural strength test

Table 23: flexural strength testfor 28 days of curing @ 0.50 Betel Nut Fiber

Sl no.	Concrete Mix	Load (KN)	Flexural Strength(N/mm2)	Average Strength in N/mm2
1	M1	128	2.98	4.45
		130	3.00	
		150	3.12	
2	M7	169	3.56	5.45
		172	3.12	
		182	3.19	



Graph 16: Graphical representation of flexural strength test

CONCLUSION

In this study, we found that aluminium powder and betel nut fibre can be used as alternatives to cement and coarse aggregates, respectively, to create a robust concrete mix in a 1:3 ratio. We learned from the aforementioned experimental checks and results that the best alternative to concrete was manufactured with 0.25,%0.5% betel nut fibre and 0.0%,0.25%,0.50%,0.75%,1.0% aluminium powder in place of cement.as supplements

- At 28 days after curing, ordinary concrete has a compressive strength of 43.99 kN/m2. It was discovered that adding 0.25% of betel nut enhanced strength by 3.74 kN/m2 in the partially replaced combination aluminium powder and betel nut fibre.
- At 28 days after curing, ordinary concrete has a compressive strength of 47.18 kN/m2. The combined aluminium powder and betel nut fibre with partial replacement yields a strength of 49.77 kN/m2 and a 5.20 increase for every 0.50% of betel nut.
- At 28 days after curing, ordinary concrete has a split tensile strength of 4.50 kN/m2. The strength is enhanced by 12.7 percent for every 0.25% of betel nut in the partially replaced combination aluminium powder and betel nut fibre, which is attained at 5.20 kN/m2.
- At 28 days after curing, ordinary concrete has a Split Tensile strength of 5.12 kN/m2. The combination partially replaced aluminium powder and betel nut fibre obtained 5.86 kN/m2 and found to have a 13.46 percent increase in strength.
- At 28 days after curing, the flexural strength of the test conventional concrete is 5.45 kN/m2. 4.20 kN/m2 of strength from the partially replaced mixture of betel nut fibre and aluminium powder was also discovered, with the strength increasing by 18.34 for every 0.25 percent betel nut.
- Conventional concrete has a flaw strength of 4.45 kN/m2@ after 28 days of curing. The combined aluminium powder and betel nut fibre that has been substituted in part is obtained at kN/m2, and it is also discovered that the strength increases by 0.5% for betel nut.

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