Experiment Investigation On Concrete With Partial Replacement Of Cement By Cow Dung Ash

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Abstract:

Experimental investigations were carried out to study the cow dung ash on the strength of concrete. Cement was partially replaced with four percentages (5%, 10%, 15%, 20%) of cow dung ash by weight in M_{20} grade concrete mix. Test performed on the concrete mix are compressive strength, splitting tensile strength and workability. The compressive strengths of the concrete specimens were determined at 7 and 28 days respectively. The tests were performed on the moulds of size (150mm x150mm x150mm).Workability test is done using compaction factor apparatus. Workability Test shows that workability of concrete decreases as percentage of cow dung ash increases in concrete mix. When compared to normal concrete the concrete containing 10% of CDA has 17% increase in compressive strength and 15% increase in Tensile Strength. The Compressive Strength and Tensile strength tends to decrease after 10%. Thus 10% replacement of cement by CDA gives satisfactory result.

1. INTRODUCTION

It is well accepted by everyone that concrete executes outstanding responsibilities for the construction of modern infrastructures and industrialization.In our project cow dung ash (CDA) is used as partial replacement of cement.

Cow Dung is obtained from cow excreta which is dried by sunlight and subjected to burning as a result, ash is obtained in black color. It is bulky and has a large ash content containing a Nitrogen rich material, Potassium, Phosphorous and Calcium.

2.MATERIALS AND METHODS

Cow Dung Ash (CDA)

Cow Dung was burnt for approximately 24 hrs in open air which was a uncontrolled burning process. Then it was allowed to cool down for 12 hrs. The ash collected was sieved through 90µ sieve . Later the sieved ash was stored in air tight container to prevent it from moisture.

Cement

The cement used in our concrete mix is fresh , free of lumps and has uniform consistency . It should be stored under dry conditions and for as short duration as possible. Ordinary Portland cement (53 Grade) conforming to IS 8112 -1989 were used in our project.

Aggregates

M-sand was used as Fine Aggregate . The sand was sieved using 4.75mm and the fraction passing 4.75mm was used in our project. The physical properties of fine aggregate were computed according to IS 383 – 1970.The sand belongs to zone – II as per IS 383 – 1970. Coarse Aggregate of size 20 mm has been used in our project.

3. LABORATORY TESTS

The following laboratory tests were carried out on percent mix for 0%, 10%, 15% and 20% replacement of cement with CDA respectively:

a. Fineness Test of cement

b. Fineness Test of Cow dung ash

c. Workability Test

d. Compressive cube Test

e. Split Tensile strength Test

a) FINENESS TEST OF CEMENT :

The fineness test of cement is done by sieving the cement samples through IS sieve. The weight of cement particles whose size greater than 90 microns is determined and the percentage of retained cement particles are calculated. This is known as fineness of cement.

Fineness of cement = W_2/ W_1 x 100 %

Where W_1 = weight of the cement sample

W_2 =weight of the cement sample retained on 90 micron sieve.

b) FINENESS TEST OF COW DUNG ASH :

The fineness test of Cow dung ash is done by sieving the cow dung ash samples through IS sieve. The weight of cow dung ash particles whose size greater than 90 micron is determined and the percentage of retained cow dung ash particles are calculated. This is known as fineness of cow dung ash

Fineness of CDA = W_2/ W_1 x 100 %

Where W_1= weight of the Cow dung ash sample.

W_2 = weight of the Cow dung ash sample retained on 90 micron sieve

c) COMPRESSIVE STRENGTH TEST

The compressive strength of the cube specimens of size 150 x 150 x 150 mm size at different replacement levels of cow dung ash (0,5,10,15,20)% were casted. These specimens were left undisturbed for 24 hours after casting. Then it is demoulded and cured for 7 and 28 days and dried for 30 minutes. These specimens were crushed each at 7 and 28 days after casting at different replacement levels of cow dung ash using the compressive testing machine in the concrete laboratory of Saranathan college of Engineering, panjapur , Trichy

$$f = P/A$$

Where,

f = Compressive Strength (N/mm^2).

P = Load at which specimen fails (N).

A = Area over which the load is applied.

d) SPLIT TENSILE STRENGTH TEST

Cylindrical specimens of 150 mm diameter and 300 mm length at different replacement levels of cow dung ash (0,5,10,15,20)% were casted. These specimens were left undisturbed for 24 hours after casting. Then it is demoulded and cured for 7 and 28 days and dried for 30 minutes. These specimens were crushed each at 7 and 28 days after casting at different replacement levels of cow dung ash using the split tensile testing machine in the concrete laboratory of Saranathan college of Engineering panjapur,Trichy,

$$T = 0.637 * p / dl$$

Where,

T = Split Tensile Strength (N/mm^2).

p = Load on the cylinder in kN.

l = Length of the cylinder in mm.

d =Diameter of cylinder in mm.

e) WORKABILITY TEST

Workability test is done using Compaction Factor apparatus. The concrete mix made up by partial replacement of cement by cow dung ash for various percentages is allowed to fall in free air from the upper hopper of compaction factor apparatus.The door of upper hopper is opened and the concrete mix is allowed to fall to second hopper. The concrete mix retained on the cylinder is then weighted. Work ability of concrete mix with partial replacement of cement by cow dung ash is calculated by the formula as given below.

Compaction factor $=(W_1-W) / (W_2-W)$

Where,

W = weight of empty cylinder

W_1 =weight of partially compacted mix

W_2 = weight of fully compacted mix

4. RESULT AND DISCUSSION

FINENESS TEST OF CEMENT :

Table 4.1 Fineness of cement

S. NO.	WEIGHT OF THE CEMENT SAMPLE (g)	WEIGHT OF THE CEMENT SAMPLE RETAINED ON 90 µ SIEVE (g)	FINENESS OF CEMENT (%)
1	100	4.58	4.58
2	100	5.92	5.92
3	100	7.58	7.58
		AVERAGE	6.4

The standard cement should have fineness less than 10 % ass per IS recommendations.

DISCUSSION :

The fineness of Cement (OPC 53) is 6.4 % hence it is recommended to use.

FINENESS TEST OF COW DUNGASH (CDA) :

Table 4.2 Fineness of CDA

S.No	WEIGHT OF THE CDA SAMPLE (g)	WEIGHT OF THE CDA SAMPLE RETAINED ON 90 µ SIEVE (g)	FINENESS OF CDA (%)
1	100	5.32	5.32
2	100	6.18	6.18
3	100	7.2	7.2
		AVERAGE	6.23

The cow dung ash should have fineness less than 10 % ass per IS recommendations

DISCUSSION :

The fineness of CDA obtained is 6.23 % hence it is recommended to use.

COMPRESSIVE STRENGTH TEST:

The Concrete cube of size (150 x 150 x 150)mm made up by partial replacement of cement by cow dung ash is tested in compression testing machine. The test results are plotted in a form of graph as shown below. From the graph it was found that the compressive strength of concrete with partial replacement of cow dung ash attains an optimum value upto 10% with compressive strength of 14.53 N/mm^2 for 7 days and 22.68 N/mm^2 for 28 days respectively. After 10% the compressive strength of the concrete tends to decrease.

Table 4.3 Average Compressive strength data and curing age.

Content	Age (days)	Percentage Replacement with CDA (%)				
		0	5	10	15	20
Average Compressive strength (N/mm^2)	7	11.88	12.25	14.53	11.5	8.59
	28	18.77	19.92	22.68	18.65	14.45

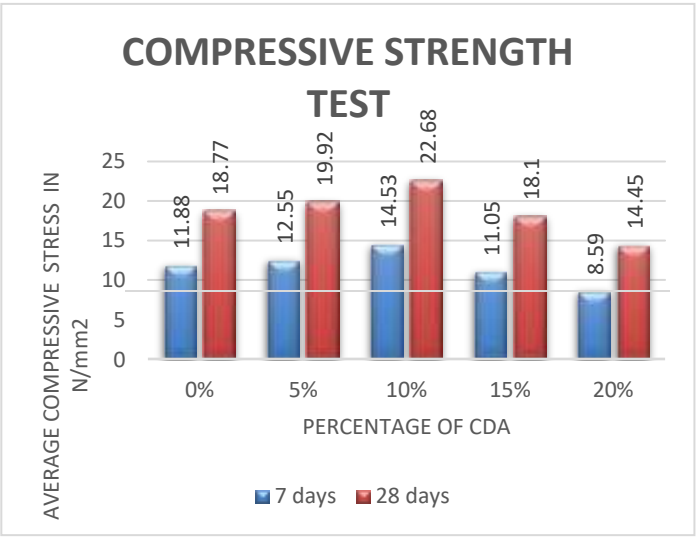

Fig.4.1. Average Compressive stress Vs Percentage of Cow Dung Ash

SPLIT TENSILE STRENGTH TEST:

Cylindrical specimens of 150 mm diameter and 300 mm length made up by partial replacement of cement by cow dung ash is tested in Split tensile testing machine. The test results are plotted in a form of graph as shown below. From the graph it was found that the tensile strength of concrete with partial replacement of cow dung ash attains an optimum value upto 10% with tensile strength of 1.72 N/mm^2 for 7 days and 2.28 N/mm^2 for 28 days respectively. After 10% the compressive strength of the concrete tends to decrease.

Table 4.4 Average split tensile strength data and curing age

Content	Age (days)	Percentage Replacement with CDA (%)				
		0	5	10	15	20
Average split tensile strength N/mm^2	7	1.56	1.65	1.72	1.38	1.19
	28	1.92	2.15	2.28	1.82	1.69

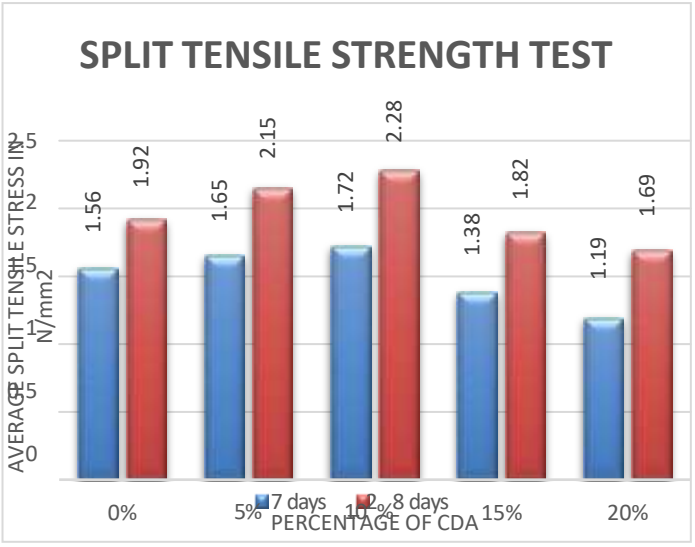

Fig. 4.2 Average split tensile stress Vs % of cow dung ash

WORK ABILITY TEST:

Workabilty Test is done using Compaction factor apparatus . The results obtained from the test is plotted in a form of graph as shown below. It was found that the workability of concrete mix made by partial replacement of cement by cow dung ash tends to decrease as percentage of cow dung ash increases.

Table 4.5 WORABILITY TEST RESULTS

PERCENTAGE OF MORTAR MIX	COMPACTION FACTOR
0%	0.90
5%	0.88
10%	0.85
15%	0.83
20%	0.80

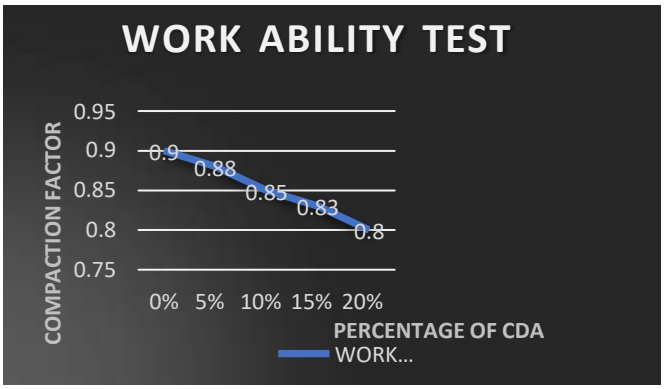

Fig 4.3. Compaction Factor Vs % of CDA

5. CONCLUSION

- From our experiment it has been found that the workability decreases as the percentage of cow dung ash increases . As the percentage of cow dung ash increases the amount of cement in concrete mix decreases due to poor w/c ratio.
- The replacement level of 10% of CDA in concrete mix yields the maximum compressive strength of 14.53 and 22.68 N/mm^2 respectively and maximum tensile strength of 1.72 and 2.28 N/mm^2
- When compared to normal concrete the concrete containing 10% of CDA has 17% increase in its compressive strength and 15% increase in Tensile strength.
- The replacement of cement with cow dung ash upto 10% leads to increase in Compressive Strength and Split Tensile Strength for 7 days and 28 days respectively.
- After 10% it leads to decrease in compressive strength and Split Tensile Strength for 7 days and 28 days respectively. This decrease in compressive strength and tensile strength of concrete above 10 % replacement of cement by cow dung ash is due to the reduction in the amount of binder content of concrete and more water is required as the percentage of cow dung ash increases in concrete mix. Thus 10% replacement of cement by CDA gives satisfactory result.

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