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A Review on Partial Replacement of Cement with Cow Dung Ash (CDA) in Concrete

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ABSTRACT

An experiment was conducted to study the effect of cow dung ash on the strength of concrete. Three percent (10%, 15%, 20%) cow dung ash by weight partially replaces cement in the M-20 grade concrete mix. Evaluation of concrete mix includes compressive strength and workability. The compressive strength of the concrete samples was measured on the 7th and 28th day, respectively. The testing was done on a mould with dimensions (150mm x150mm x150 mm). Performance measurement is done using the compaction factor Apparatus. Performance analysis shows that the performance of concrete decreases as the proportion of cow dung ash in the concrete mixture increases. Concrete containing 10% CDA showed a 17% increase in compressive strength compared to plain concrete. Compressive strength can be reduced after 10%. Therefore, good results can be achieved by replacing 10% cement with CDA. An experiment was conducted to study the effect of cow dung ash on the strength of concrete. Three percent (10%, 15%, 20%) cow dung ash by weight partially replaces cement in the M-20 grade concrete mix. Evaluation of concrete mix includes compressive strength and workability. The compressive strength of the concrete samples was measured on the 7th and 28th day, respectively. The testing was done on a mould with dimensions (150mm x150mm x 150mm). Performance measurement is done using the compaction factor tool. Performance analysis shows that the performance of concrete decreases as the proportion of cow dung ash in the concrete mixture increases. Concrete containing 10% CDA showed a 17% increase in compressive strength compared to plain concrete. Compressive strength can be reduced after 10%. Therefore, good results can be achieved by replacing 10% cement with CDA.

I. INTRODUCTION

As we all know, stone plays an important role in modern construction and industry. In our project, cow dung ash (CDA) was used instead of cement. Cow dung is obtained from cow, dried in the sun and then burned to obtain black ash. It is large, has high ash content and contains nitrogen, potassium, phosphorus and calcium.

Properties of cow dung ash

In this study cement % is reduced by adding cow dung ash. CDA has good binding properties and it reduces voids in concrete. Physical properties of cow dung:

a) It is bulky
b) It has large ash content
c) It has low volatile content after burning.
d) Carbon content is low
e) Burning ratio is low
f) Low thermal conductivity
g) Eco-friendly material
h) Economical
i) Easily available

II. MATERIALS

Cow dung is burned in the open air in an uncontrolled burning process for approximately 24 hours. Then let it cool for 12 hours. The collected ash was passed through a 90µ sieve. The sieve ash is then stored in airtight containers to protect it from moisture.

a. Cement

The chocolate is a good, soft and well made product. It is made from a mixture of components derived from modern materials such as limestone, soil, sand and shale. When mixed with water, the binder binds sand and rock into a hard, solid material called concrete. Portland Bond is produced by crushing, processing and proportioning the ingredients.

1. Lime or calcium oxide, CaO: from limestone, chalk, shells, shale or calcareous shake.
2. Silica, SiO2: from sand, old containers, mud or argillaceous shake
3. Alumina, Al2O3: from bauxite, reused aluminum, earth
4. Iron, Fe2O3: from earth, press mineral, piece iron and fly powder.
5. Gypsum, CaSO4.2H20: found together with limestone.

b. Fine Aggregates

M-sand is used as fine aggregate. The sand was sieved using 2.00 mm and the fraction passing 2.00 mm was used for our analysis. Physical properties of fine aggregate have been calculated as per IS 383 - 1970. Sand falls in Zone II as per IS 383 - 1970. In our analysis, 20 mm size coarse aggregates were used.

c. Cow dung Ash

Cow manure contains plenty of nitrogen, potassium and calcium chemistry. It has a very high carbon/nitrogen ratio. However, its physical properties are large size, large ash and low content. The dung ash coming from the village is dried in the sun, burned and cooled at a temperature of 450 to 500 ° C. After cooling, it is ground into powder, sieved through a 300 micron sieve and stored in an airtight container to prevent moisture. Cow dung is dried in the sun to obtain dung cake and after drying it is burned to obtain black colored cow dung ash.

d. Water

Water is an important component of cement mortar. When cement comes into contact with water, an exothermic reaction occurs and cement solidification begins. The water used in the mixture must be fresh, organic and free of problematic solutions, otherwise it will cause the mortar to deteriorate. Salt water is not accepted, but chlorinated drinking water is. Drinking water and water mixed with ice are suitable for use.

III.METHODOLOGY & LABORATORY TESTS

The following laboratory tests were carried out on percent mix for 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

a) Fineness test of cement

The fineness take a look at of cement is finished by sieving the cement samples via IS sieve. the weight of cement particles whose size greater than ninety microns is determined and the proportion of retained cement debris are calculated. that is called fineness of cement.

$$\text{Fineness of cement} = W_2 / W_1 \times 100\ \%$$

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

Cow dung is burned in the open air in an uncontrolled burning process for approximately 24 hours. Then let it cool for 12 hours. The collected ash was passed through a 90μ sieve. The sieve ash is then stored in airtight containers to protect it from moisture.

Fineness of CDA = W2/ W1 x 100 %

Where W1= weight of the Cow dung ash sample.

W2 = weight of the Cow dung ash sample retained on 90 micron sieve

c) Workability Test :

Workability test is done using a 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 the compaction factor apparatus. The door of the upper hopper is opened and the concrete mix is allowed to fall to the 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

d) Compressive strength test:

The compressive power of the dice specimens of size one hundred fifty x one hundred fifty x one hundred fifty mm length at specific alternative stages of cow dung ash (10,15,20)% had been casted. Those specimens have been left undisturbed for 24 hours after casting. Then it's far remolded and cured for 7 and 28 days and dried for 30 minutes. these specimens have been crushed each at 7 and 28 days after casting at different alternative degrees of cow dung ash the use of the compressive trying out device within the concrete laboratory, Tricky

$$f = P/A$$

Where,
f = Compressive Strength (N/mm^2).
P = Load at which specimen fails (N).
A = Area over which the load is applied

IV. RESULT AND DISCUSSION

a) Fineness test of cement :

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

TABLE I
FINENESS OF CEMENT

S. No.	Weight of the cement Sample	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

Discussion: The fineness of cement (POC 43) is 6.4 % hence it is recommended to use.

b) Fineness test of cow dung ash (CDA) :

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

TABLE II
FINENESS OF CDA

S. No.	Weight of the cement Sample	Weight of the CDA sample Retained on 90 µ sieve (g)	Fineness of Cement
1	100	5.32	5.32
2	100	6.187	6.18
3	100	7.2	7.2

Average	6.23

Discussion: the fineness of CDA obtained is 6.23% hence it is recommended to use.

e) Workability Test :

Workability Test is done using Compaction factor apparatus. The results obtained from the test are 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 III
Workability test results

PERCENTAGE OF MORTAR MIX	COMPACTION FACTOR
10%	0.85
15%	0.83
20%	0.8

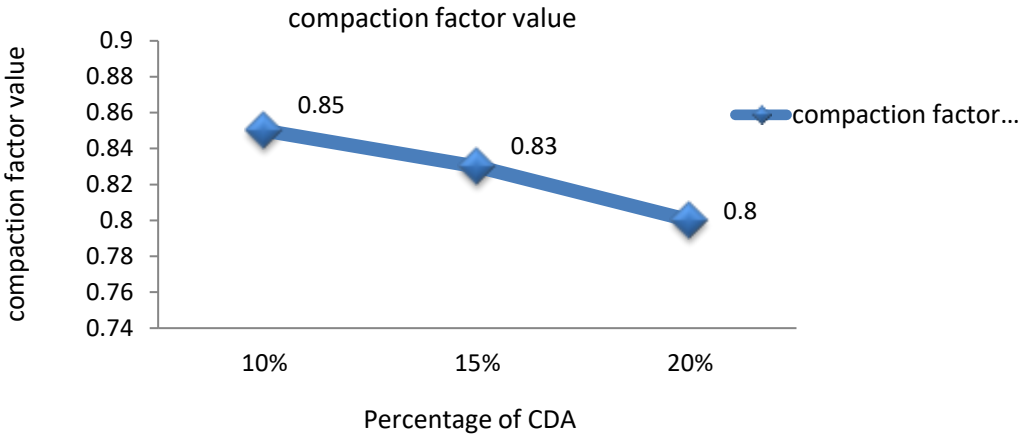

Fig. 2 . Compaction Factor Vs % of CD

f) Compressive strength test:

A concrete block of size (150 × 150 × 150) mm made using cow dung ash instead of cement was tested in a compression tester. The test results are shown in the graph as shown below. As can be seen from the figure, the compressive strength of concrete partially modified with cow dung ash reaches a good value, which can reach 10%. The 7-day compressive strength is 14.53 N/mm^2 and the 28-day compressive strength is 22.68. N/mm^2. The compressive strength of concrete starts to decrease after 10%.

TABLE III
Average compressive strength data and curing age

content	age	Percentage replacement with CDA (%)

Average compressive strength (N/mm^2)		10	15	20
	7	14.53	11.5	8.59
	28	22.68	18.65	14.45

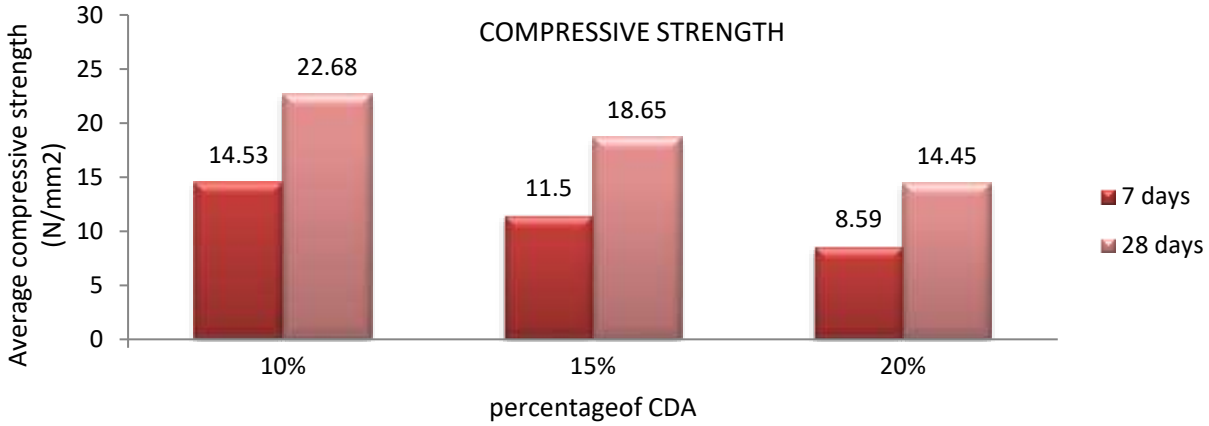

Fig.1

Average Compressive stress Vs Percentage of Cow Dung Ash

I. CONCLUSION

II. 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.

III. The replacement level of 10% of CDA in concrete mix yields the maximum compressive strength of 14.53 and 22.68 N/mm2 respectively.

IV. When compared to normal concrete the concrete containing 10% of CDA has 17% increase in its compressive strength.

V. The replacement of cement with cow dung ash up to 10% leads to increase in Compressive Strength 7 days and 28 days respectively.

VI. After 10% it leads to decrease in compressive 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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