EXPERIMENTAL STUDY ON PROPERTIES OF PLASTER WITH REPLACEMENT OF CEMENT BY COWDUNG AND FLY ASH

Alisha Jawade [1] Avinash rasure[2] Nawal sawayya [3] Nilesh gaydhane[4] Rahul Parteti,[5] Shubham Chahande,[6] Shahbaz Sheikh [7] Vaishnavi Chhatre [8]Mr. Rohit Bhosle[9] Mrs. Prerana Salodkar[10]

1Under Graduate student, NIT College of Engineering Nagpur, India
2Under Graduate student, NIT College of Engineering Nagpur, India
3Under Graduate student, NIT College of Engineering Nagpur, India
4Under Graduate student, NIT College of Engineering Nagpur, India
5Under Graduate student, NIT College of Engineering Nagpur, India
6Under Graduate student, NIT College of Engineering Nagpur, India
7Under Graduate student, NIT College of Engineering Nagpur, India
8Under Graduate student, NIT College of Engineering Nagpur, India
9 Professor, NIT College of Engineering Nagpur, India
10 Professor, NIT College of Engineering Nagpur, India

Abstract – This study has been undertaken to investigate the Replacement of Cement with Cow dung ash as well as Fly Ash as in today's Scenario we suffer with a lots of shortage of materials in construction industries so this is a trail purpose of us to use cow dung and fly ash as a replacement in plaster and at the end we identify the problems as well as the benefits of the vedic plaster. As in ancient time and also in present time rural areas of India Cow Dung is used for flooring and also for a coat on the wall so we decided to Replace Cement with Cow dung and fly Ash.

Index Terms – Plastering, Cement, Sand, Fly Ash, Cow dunk.

I. INTRODUCTION

In civil engineering, concrete is the most often used man-made building material. Since 1990, the world's cement production has expanded along with the demand for concrete as a building ingredient. Because of human activity, the atmosphere is filled with greenhouse gases like CO2, which contribute to global warming. CO2 makes up roughly 65% of the greenhouse gases that cause global warming. Because the manufacture of one tonne of Portland cement releases around 0.9 tonnes of CO2 into the atmosphere, the cement sector is to blame for about 6% of all CO2 emissions (Nazeer and Kumar, 2014).

Additionally, this gas contributes to the destruction of the ozone layer, which causes global warming (Shalini et al., 2006). Additionally, the majority of the people, who are low-income, has difficulty due to the rising cost of cement in developing countries (Omoniyi et al., 2014). Therefore, finding other cementitious materials to use as a partial alternative for cement is necessary. As a partial replacement for cement in concrete, several researchers have employed materials such as sawdust ash, cow dung ash, rice husk ash, fly ash, and granulated blast furnace slag (Matawal and Duna, 2002; Nazeer and Kumar, 2014; Ojedokun et al., 2014). The amount of CO2 emissions produced when making cement can be decreased thanks to these efforts.

India produces over 140 million metric tonnes of fly ash each year, but there are issues with its safe disposal, which has led to environmental degradation. In cement concrete, where it is most frequently used, fly ahs has been suggested for use by numerous researchers (Patil et al., 2010). Fly ash is an inexpensive additive to concrete that improves its workability, strength, and abrasion resistance in both the fresh and hardened forms of the concrete (Atis, 2005). According to Malhotra (1999), greater usage of huge quantities of fly ash and other supplemental cementing ingredients in the concrete industry can significantly reduce the emission of CO2 that is contributed by the Portland cement sector.

The cow dung is made from cow excrement that has been baked and dried in the sun. Cow dung that has been dried and caked is utilised as fuel in many underdeveloped nations. The fuel ash is produced as a dark substance. According to Rayaprolu and Raju (2012), cow dung contains calcium, potassium, phosphorous, and nitrogen. They researched the use of cow dung ash as an additional cementing component in concrete and mortar. The amounts of these components were replaced by cement and the rock and brick were utilised as coarse aggregate in the creation of concrete cubes since these materials can be used to partially replace cement. The prepared cubes' compressive strength the various curing times and rock and brick aggregates were evaluated for the comparison.

II. METHODOLOGY

In this investigation, concrete cubes were prepared using fly ash and cow dung ash in place of various percentages of cement. Ordinary portland cement of grade 43 was utilised in the experiment. The Thermal Power Plant Khedar in Haryana, India is where the fly ash was gathered. Fly ash with cow dung were used to replace 0%, 5%, 10%, 15%, and 20% of the cement, respectively. Brick and rock aggregates were utilised as coarse aggregates in concrete. The study employed coarse aggregates with a maximum size of 10 mm and 20 mm.

Mix Design

For the suggested concrete mix, the M20 mix design was computed. The amounts of coarse aggregates (rock and brick), sand, and water remained constant but the amount of cement dropped as fly ash and cow dung ash concentrations rose. On a weight basis, the ratios of cement, fly ash, and cow manure were estimated.

Mix Proportions

Four proportions of mix design, including 100 percent cement, 95 percent cement + 2.5 percent fly ash + 2.5 percent cow dung ash, 90 percent cement + 5 percent fly ash + 5 percent, 85 percent cement + 7.5 percent fly ash + 7.5 percent cow dung ash, and 80 percent cement + 10 percent fly ash + 10 percent cow dung ash were taken into consideration for the preparation of concrete cubes with rock aggregate. The proportions remained the same but brick was used as the coarse aggregate while making concrete cubes with brick aggregate. Brick aggregate had a specific gravity of 2.35 while rock aggregate had a specific gravity of 2.80.

Preparation of Cube

Using different ratios of fly ash and cow dung ash, concrete cubes of 150x150x150 mm were produced in standard moulds at three intervals (about 50 mm each). A compaction rod gave concrete 25 strikes at each interval to compact it. After the third break, cubes were vibrated on a machine for one to two minutes before having their top surfaces polished with a trowel. The moulds were then dried for 24 hours after that. The cubes were taken out of the moulds after 24 hours and placed in water tanks to cure.

Curing of concrete cubes

The cubes made with rock and brick aggregates and various ratios of cement, fly ash, and cow dung were dried for various lengths of time: three days, seven days, fourteen days, twenty-one days, and thirty-eight days.

Testing of concrete cubes

Utilizing a 40-ton universal testing machine, the compressive strength of the samples was measured after curing for 3, 7, 14, 21, and 28 days.

III. RESULT AND DISCUSSION

Separate set of concrete cube samples were prepared using coarse aggregate as rock and brick materials. Cement was replaced by fly ash (FA) and cow dung ash (CDA) in different proportions. Local river sand and potable water was used during preparation of concrete cubes. The cubes were cured for the period of 3 days, 7 days, 14 days, 21 days and 28 days. Then the compressive strength of cured samples was determined using Universal Testing Machine. The details of the results are as under:

1. Fine Aggregates Sieve Analysis

ASTM Sieve Size	Weight Of Retained	Cumulative Of Weight Retained (g)	% Cumulative Of Weight Retained (g)	% Passing
4.75mm	22.07g	22.07	1.1035	98.8965
3.36mm	100.86g	122.93	6.1465	93.8535
1.18mm	768.03g	890.96	44.548	55.452
600micron	500.82g	1391.78	69.589	30.411
300micron	560.44g	1952.22	97.611	2.389
150micron	47.21g	1999.43	99.9715	0.0285
Pan	0.58g	2000.01	100.0005	-0.0005
			318.97	281.03

Fineness modulus (F.M) = ∑ (Cumulative % retained)/100=318.97/100=3.1897

2. Coarse Aggregates Sieve Analysis

Sieve Size	Weight Retained (g)	%Weight Retained (g)	Cumulative % Weight Retained	%Passing
40mm	0	0	0	100
37.5mm	0	0	0	100
25mm	533.34	10.67	10.67	89.33
20mm	4081.84	81.64	92.31	7.69
16mm	304.94	6.10	98.41	1.59
12,5mm	62.72	1.25	99.66	0.34
10mm	1.58	0.03	99.69	0.31
4.75mm	15.58	0.31	100	0
Pan	0	0	100	0
Total	5000	100	500.74	

Fineness modulus (F.M) = ∑ (Cumulative % retained)/100=500.74/100=5.0074

3. Workability Results

FA + CDA	0%	5%	10%	15%	20%
Slump	45	49	56	68	75

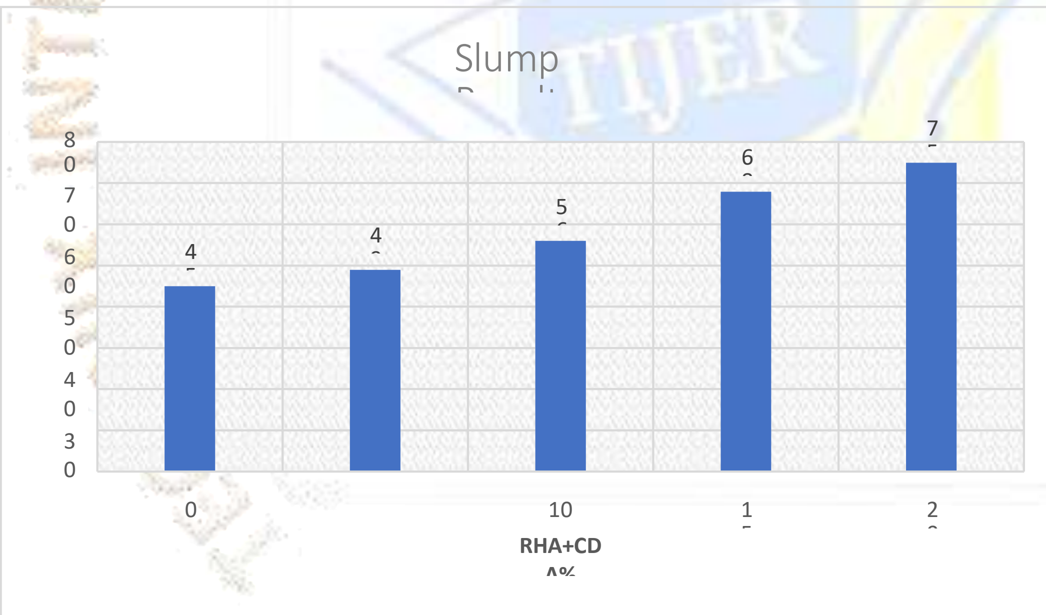

Fig No. 1 Bar Chart Representing Slump Test Results

4. Density of Concrete

CDA + FA	7 Days	14 Days	28 Days
0%	2451.83	2452.73	2452.53
5%	2369.7	2371.13	2370.8
10%	2379.8	2382.0	2380.0
15%	2346.7	2349.07	2348.5

5. Cube Strength of CDA + FA Varying the Percentage for Replacement of Cement at 28 Days of Curing

% CDA in Cement	Cube Size (mm^2)	Cube Area (mm^2)	Water/ Cement	Weight Of Cube (Kg)	Density of Cube (Kg/M m^3)	Crushing Load (kN)	Cube Strength (N/mm^2)
0%	100mmx 100mm	10000	0.5	2.45	2452.53	375.0	37.75
5%	100mmx 100mm	10000	0.5	2.37	2370.80	312.5	31.25
10%	100mm x 100mm	10000	0.5	2.38	2380.80	312.5	31.25
15%	100mm x 100mm	10000	0.5	2.35	2348.5	252.5	25.25

6. Strength of CDA + FA Varying the Percentage for Replacement of Cement at 28 Days of Curing

FA + CDA	Compressive strength of concrete (N/mm^2)
0%	37.75
5%	31.25
10%	31.25
15%	25.25

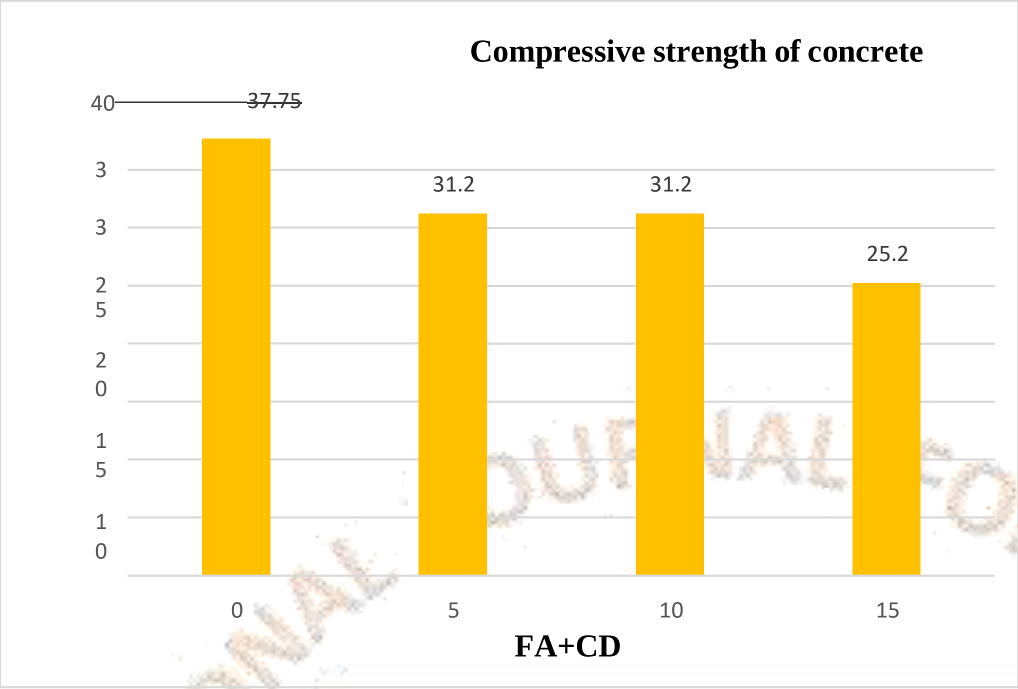

Fig. no. 2 Bar Chart Representation of Compressive Strength of Cubes Against Curing Periods

IV. CONCLUSION

The study's findings are as follows.

1. When a ten percent (10%) replacement is not exceeded, cow dung ash and fly ash concrete can be made to perform effectively in several floor and wall applications.
2. The amount of water required by the Cow Dung Ash and Fly Ash increases as the percentage in the concrete rises; as a result, it has a major limitation that must be recognized before to use.
3. The advantages of the cow dung ash and fly ash are their light weight, which makes them good building materials.
4. As the amount of CDA+FA grows, more water is needed to attain the desired consistency.
5. As CDA+FA content rises and rises as the curing time is prolonged, compressive strength drops.
6. To make good and high-quality mortar and concrete, CDA+FA of no more than 15% can be utilized as a criterion.

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