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Modification of Lime-Cement Plaster by Introducing Mineral Admixture in Advance

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Abstract: ***Lime-cement plaster sees widespread use as a building material. People know it for its ability to last, let air through, and be easy to work with. But adding natural ingredients can make it even better, turning it into a more eco-friendly and cost-effective option. This research looks at what happens when you mix cow dung into lime cement plaster. For years, people have used cow dung in earth-based building. It's full of plant fibers and tiny living things. Builders value it because it helps things stick together, keeps water out, and fights off germs. This study looks at how well plaster works when mixed with different amounts of cow dung. It checks how easy the plaster is to use, how long it lasts, how well it keeps out water, and how well it insulates against heat. The results show that adding cow dung makes the plaster more flexible and less likely to crack while still keeping its strength. It also improves the plaster's heat retention capabilities and serves as a natural alternative to synthetic additives. The study concludes that cow dung could be a suitable natural supplement to lime-cement plaster. This supports friendly manufacturing practices and reduces reliance on chemical-based additives.***

Keywords: Compression Strength (CS), Britis Sieve (BS), Cow dung Powder (CDP).

I. INTRODUCTION

Cow dung was found to be a material most suitable in increasing both internal moisture absorption and the percentage of water loss through solubility. So, this kind of ability will be widely used in the place of chemical solutions created previously for such moisture regulation in construction materials. Lime cement plaster is named eco-plaster, as it is a highly sustainable material and has pleasant, good resistance properties to moisture and water, used in various civil applications. Cow dung has also been found to improve workability, resist cracking, insulate thermally, and enhance the strength of cement lime plaster. It increases its durability as well as lowers water ingress, making it a possible substitute for synthetic additives. This research aimed to address the integration of cow dung in different proportions to learn of its effect on physical and mechanical attributes related to lime cement plaster.

II. MATERIAL USED

1) Cement

Cement is the binding agent that is use to bind various constructin materilas. Due to its adhesive and cohesive properties, it is an essential ingredieent of concrete and morter. Cment is mixed With Water To form a paste that binds aggregate like sand or crushed rock. Cement used in construction are usually inorganic, either lime- or calcium-silicate-based, and are other hydraulic or, less commonly, non-hydrolic, depending on the ability of the cement to set in the presence of water. The manufacturing of cement is the temperature of the binding zone of the rotary kiln, where cement components are heated to form clinker, which s around 1300-1500 degree Celsius (2375-2642 F). Accurate temperaature measurements are important for the quality of the product. The densiy of cement is 1440 kg/cube meter; the specific gravity of cement is the ratio of the weight of a given volume of cement to the weight of an equal volume of water.

Fig 1: - Cement

2) Lime

Lime is an inorganic material composed primarily of calcium oxides and hydroxides. It is also the name for calcium oxide, which occurs as a product of coal-seam fires and in altered limestone xenoliths in volcanic ejecta. The International Mineralogical Association recognizes lime as a mineral with the chemical formula of CaO. The word lime originates with its earliest use as building mortar and has the sense of sticking or adhering. These materials are still used in large quantities as building and engineering materials (including limestone products, cement, concrete, and mortar), as chemical feedstocks, for sugar refining, and for other uses. Lime industries and the use of many of the resulting products date from prehistoric times in both the Old and the New World.

Fig 2:- Lime

3) Fine Aggregate

Fine aggregate is a crucial component in construction materials, particularly in concrete and mortar. It primarily consists of natural sand, crushed stone, or manufactured sand that passes through a 4.75 mm (No. 4) sieve. Fine aggregate serves as a filler material and helps in achieving a dense, compact concrete mix.

Sieve Analysis Test

Sieve analysis test is the separation of aggregate into fraction. Each fraction consists of particles with specific limit, these being openings of standard test sieves. The CDP was placed in BS sieve which has sieves mount in frame so that they are place on one above the other with large sieve size at the top and the smallest at the bottom. The material is poured from the top and the sieve is given a vigorous shake mechanically. After shaken the material retained on BS sieve represent the function of the fine aggregate

4) Admixture (cow dung)

Cow dung (cow manure) is the waste excreted by cows, used for multiple purposes. Its rich organic matter and nutrients make it a great natural fertilizer, enriching soil fertility and plant growth. Cow dung is commonly utilized in rural regions for fuel, either in dry cake or biogas production, which serves as an eco-friendly energy source. Its use is found in traditional medicine and construction, where it is added to mud to reinforce walls and floors. Cow dung is an extremely good source for agriculture and sustainable living due to its multiple advantages."Cow dung (cow manure) is the waste excreted by cows, used for multiple purposes. Its rich organic matter and nutrients make it a great natural fertilizer, enriching soil fertility and plant growth. Cow dung is commonly utilized in rural regions for fuel, either in dry cake or biogas production, which serves as an eco-friendly energy source. Its use is found in traditional medicine and construction, where it is added to mud to reinforce walls and floors. Cow dung is an extremely good source for agriculture and sustainable living due to its multiple advantages.

Fig 4 :- Cow dung Powder

III. METHODOLOGY

A. Materials Needed:

The following materials are used for preparing the lime-cement plaster:

1) Lime (hydrated or slaked)
2) Cement (Ordinary Portland Cement)
3) Sand (fine and clean)
4) Cow dung powder (well-dried and finely ground)
5) Water

B. Preparation of Cow Dung Admixture

1) Cow dung is sun-dried for 3-5 days to remove excess moisture.
2) The dried material is sieved to remove large particles.
3) It is the mixed with water to create a paste-like consistency for even distribution in plaster.

C. Mix Proportions

For the preparation of morter cubes with fine aggregate, 3 proportions of mix design such as 100% cement, first in 70% cement + 25 % lime + 5 % cow dung powder, 60 % cement + 25 % lime + 15 % cow dung powder, 50 % cemnt + 25 % lime + 25% cow dung powder. For the preparation of morter cubes with brick wall, the proportions were same but the fine aggregate was brick.

D. Mix Proportions

For the preparation of morter cubes with fine aggregate, 3 proportions of mix design such as 100% cement, first in 70% cement + 25 % lime + 5 % cow dung powder, 60 % cement + 25 % lime + 15 % cow dung powder, 50 % cemnt + 25 % lime + 25% cow dung powder. For the preparation of morter cubes with brick wall, the proportions were same but the fine aggregate was brick.

E. Preparation of concrete cubes

The prepared mortar is placed in clean, oiled cube molds (usually 70.6 mm x 70.6 mm x 70.6 mm) in three layers, with each layer being compacted using a tamping rod or vibrating table to eliminate air voids. The filled molds are kept in a moist environment for 24 hours before demolding, after which the cubes are submerged in a curing tank at a controlled temperature (27 ± 2°C) for the specified curing period (7, 14, or 28 days). On the testing day, the cubes are removed, surface moisture is wiped off, and they are tested for compressive strength using a testing machine.

F. Application of Plaster

1) The prepared plaster is applied on pre-moistened brick surface using a trowel.
2) A thickness of 12-15mm is maintained.
3) The surface is leveled and smooth using wooden floats.

G. Curing Process

1) The plastered surface is cured for 7 & 28 days by sprinkling water twice daily.
2) Curing ensure proper hydration and bonding strength.

H. Testing & Evaluation

1) Compressive Strength using compression machine
2) Water Absorption (to evaluate permeability)
3) Adhesion Strength (to check bonding with the substrate)
4) Thermal insulation properties (to assess heat resistance)
5) Crack resistance (to observe surface durability over time)

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IV. RESULTS

A. *Compression Cube test:*

Table No: -1 Compression test for 7 days curing & add by 5% Cow dung powder

Sr. No.	Load in KN	Compression strength (Mpa)	Mean CS
1	70	14.04	13.03
2	60	12.03	
3	65	13.04	

Table No: -2 Compression test for 28 days curing & add by 5% Cow dung powder

Sr. No.	Load in KN	Compression strength (Mpa)	Mean CS
1	80	16.05	16.04
2	75	15.04	
3	85	17.05	

Table No: -3 Compression test for 7 days curing & add by 15% Cow dung powder

Sr. No.	Load in KN	Compression strength (Mpa)	Mean CS
1	80	16.05	15.04
2	75	15.04	
3	70	14.04	

Table No: -4 Compression test for 28 days curing & add by 15% Cow dung powder

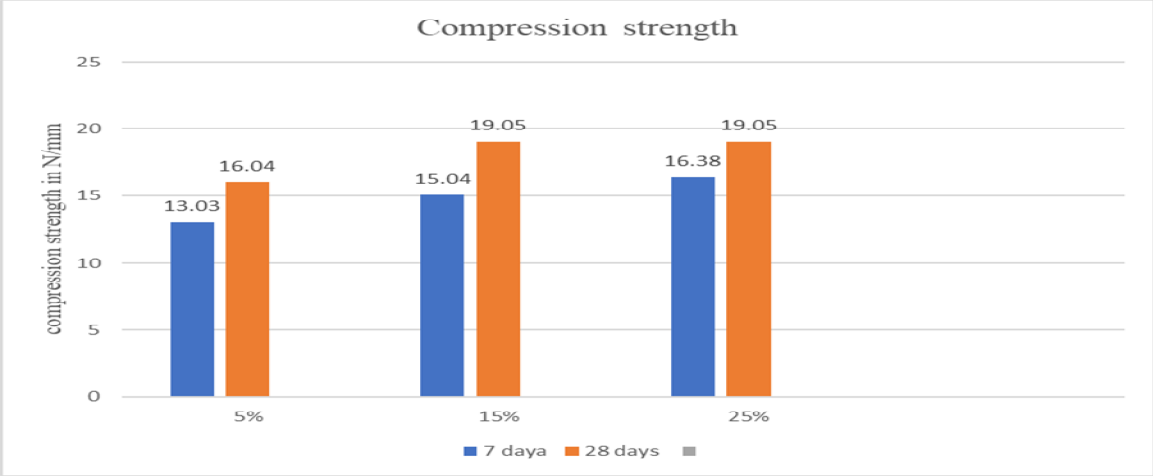
Sr. No.	Load in KN	Compression strength (Mpa)	Mean CS
1	100	20.06	19.05
2	90	18.05	
3	95	19.05	

Table No: -5 Compression test for 7 days curing & add by 25% Cow dung powder

Sr. No.	Load in KN	Compression strength (Mpa)	Mean CS
1	80	16.05	16.38
2	85	17.05	
3	80	16.05	

Table No: -6 Compression test for 28 days curing & add by 25% Cow dung powder

Sr. No.	Load in KN	Compression strength (Mpa)	Mean CS
1	90	18.05	19.05
2	95	19.05	
3	100	20.05	



Graph:- A sample line graph using colors which contrast from compression strength

V. CONCLUSIONS

1) Though the cubes prepared with morter and cement showed the highest compressive strength at 28 days of curing but no significant differences in compressive strengths of cubes prepared by cement and 25% of cow dung plus were observed on any day of curing indicating that cement can be replaced by 25% of these materials.

2) The study revealed that cow dung powder being waste materials can be utilized for the Morter preparation.

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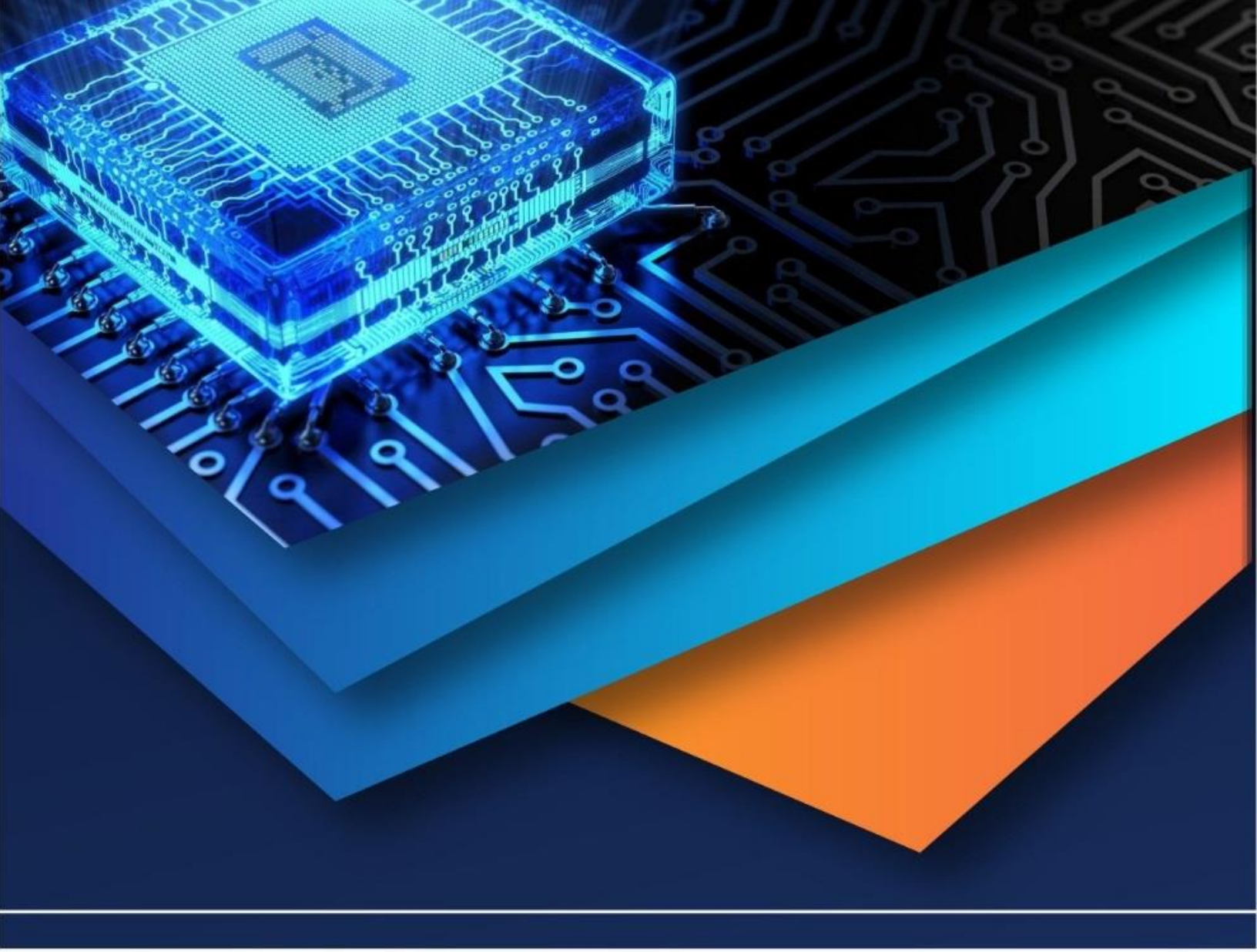

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