A Review Article on Cow-dung As Building Material

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Abstract: For sustainable development and to promote local available material, the use of cow-dung in house construction is a good choice of research. By introducing "cow-dung," as a new construction material, focus on bringing this brick material into a new and sustainable domain. Research indicates that incorporating 5 to 10% cow-dung ash in brick production significantly boosts their tensile strength. This exemplifies the potential of cow-dung as a transformative element in sustainable construction.

Keywords: Cow Dung, brick material, building material, sustainability

1. Introduction

As is well known, in today's time, the importance of renewable energy is increasing. With the growing population, the demand for housing is also rising. It's common knowledge that various types of bricks are used in construction, such as first-class common building bricks, second-class bricks, sundried bricks, fly ash bricks, AAC blocks, and so on. To introduce a new material, "cow-dung," in the field of renewable energy, we have focused on bringing this brick material into a new and sustainable domain.

In the quest for more sustainable and eco-friendly construction practices, there has been a resurgence of interest in traditional building materials and techniques. One such material that has gained attention in recent years is cow dung. While it may seem unconventional at first, cow dung has a long history of use in construction in various parts of the world, and its remarkable properties make it a viable candidate for sustainable building practices.

In pursuit of renewable construction, many are turning to cow-dung as a pivotal resource. historical importance of cow-dung has spurred a dedicated effort in various fields. Cow-dung is now being harnessed to create superior alternatives such as bricks, plaster, and paint. This has elevated cow-dung to a more effective and eco-friendly choice compared to conventional materials. Research indicates that incorporating 5 to 10% cow-dung ash in brick production significantly boosts their tensile strength. This exemplifies the potential of cow-dung as a transformative element in sustainable construction.

Cow dung, also known as cow manure or cow pats, is a readily available resource in many rural and agricultural communities. Traditionally, it has been employed as a fertilizer, fuel, and even for its medicinal properties. However, its potential as a building material has largely been overlooked until relatively recently. The use of cow dung in construction is an environmentally friendly and cost-effective alternative to conventional building materials like cement and bricks.

Cow dung plays a significant role in building materials, especially in sustainable and eco-friendly construction practices. Its unique properties make it a valuable resource for various applications in construction. Here are the key roles of cow dung in building materials:

Binder and Strength Enhancer: Cow dung contains a significant amount of lignin and cellulose, which act as natural binders, enhancing the strength and cohesion of building materials. When mixed with other natural materials like clay or earth, cow dung can improve the structural integrity of construction elements such as bricks and blocks.

Thermal Insulation: Cow dung has excellent thermal insulation properties, helping to regulate indoor temperatures. Buildings constructed with cow dung-based materials are often more comfortable, as they provide insulation against both heat and cold, reducing the need for energy-consuming heating or cooling systems.

Humidity Control: Cow dung-based materials can help control indoor humidity levels. They can absorb excess moisture and release it gradually, contributing to a more stable and comfortable indoor environment.

Sustainable and Renewable Resource: Cow dung is a readily available and renewable resource in many agricultural communities. Its use in building materials reduces the dependence on non-renewable

resources like cement and bricks, thereby promoting sustainability and reducing the carbon footprint.

Low Environmental Impact: The production and use of cow dung-based building materials generally have a lower environmental impact compared to conventional materials. This is because cow dung is a natural, biodegradable resource that does not require energy-intensive manufacturing processes.

Cost-Effective Alternative: Cow dung is an inexpensive or often free resource in many rural areas, making it a cost-effective alternative to conventional building materials.

Cultural and Historical Significance: Cow dung has a long history of use in various cultures, particularly in rural settings. Utilizing cow dung in building materials preserves cultural traditions while also adapting them to modern construction needs.

Biogas Production: Cow dung can be used not only as a building material but also as a raw material for biogas production. This biogas can serve as a sustainable energy source for cooking, heating, and lighting in homes, further enhancing the sustainability of the building.

Community and Economic Benefits: The use of cow dung in building materials can provide additional sources of income for farmers and local communities. It encourages community involvement and can contribute to rural development.

2. Cow-dung as a construction material

Cow-dung, historically venerated in India, is traditionally considered sacrosanct and is sourced from healthy cattle. Cow-dung and cow urine are recognized by its ritualistic and purifying properties. From a scientific standpoint, cow-dung is rich in diverse minerals, rendering cow-dung to a valuable resource for various renewable applications. Cow-dung utilization spans across multiple domains, with ongoing scholarly investigation into its potential.

In India's historical architectural practices, cow-dung, in conjunction with soil, is employed for the construction of residences and courtyards. Vedic architectural principles endorse the use of cow-dung in plaster and bricks due to their exceptional resilience. The annual production of cow-dung amounts to a substantial 1212 million tons, further underscoring its significance as a resource [1].

Mix for brick manufacturing-

MIX = Cow-dung (78% -80%) + Lime 20% + Cow Urine (1-2 %)

(1)

For Vedic Plaster

MIX = Cow-dung 30% +Gypsum 60 %+Gawar gum (5%) +Mud (3%)+Water (2%) +Citric acid (1%)

(2)

Certainly. Cow-dung, when employed as a building material in the form of cob, represents an ancient architectural method. Cob is crafted by amalgamating indigenous clay, cow-dung, and straw. Cob maintains a stable thermal profile, exhibiting insulating properties that preserve warmth during colder seasons and promote cooling in warmer climates. This inherent feature significantly augments the energy efficiency of structures. Furthermore, cow-dung can be utilized in a manner akin to adobe, a distinct building material. In this process, cow-dung is moulded into brick shapes and subjected to sun-drying, facilitating its structural application [2].

When bricks are produced by incorporating soil and Fiber into cow-dung, results in a reduction of CO2 emissions by up to 90%, while concurrently enhancing the structural integrity of the bricks by approximately 20%. This approach is currently being implemented in a project based in Uganda [3]. In the Sungani region of Ghana, an evaluation was conducted on earth bricks stabilized by cow-dung to assess their strength and durability. Point was made that after a 10-minute immersion in water, there was a significant difference in the compressive strength of the bricks. Cow-dung stabilization substantially reduced fine absorptivity from 16.8% with 0% cow-dung content to 10.4%. Moreover, increasing it to 20% further enhanced abrasion resistance[4]. In the Netherlands, research initiatives such as NWO and NWA have endorsed the proposition of utilizing bricks composed of a mixture of mud and cow-dung. This approach engenders a sustainable circular impact, exemplifying principles of a circular economy and resource efficiency [5].

Indeed, this approach has spurred the establishment of small-scale businesses. For small-scale operations, an area ranging from 1500 to 2000 square feet suffices, while larger-scale endeavours necessitate an area spanning from 2000 to 5000 square feet. This formulation comprises the following essential raw materials: Cow-dung: 0.4 kilograms, Lime: 400 to 600 grams, Gypsum: 50 to 100 grams, Guar gum (as necessary), Lemon juice/citric acid (as required), Water (as needed). This combination forms the foundational constituents for producing construction materials utilizing cow-dung. It demonstrates considerable

promise for sustainable building applications[6].

By considering sustainability of construction materials incorporating cow-dung and cow waste, results in guide to towards a positive ecological direction. These materials exhibit properties of being lightweight and breathable, contributing to a favourable ecological impact[7]. Incorporating 10%, 20%, or 30% cow-dung into construction materials, followed by sun-drying and subsequent incineration to obtain ash, reveals that integrating 10%, 20%, or 30% of this ash directly replaces 10% of the strength of the bricks [8]. In the microstructural examination, the influence of cow-dung was scrutinized, revealing the presence of truncated, undigested Fibers consisting of cellulose, hemicellulose, and lignin. When cow-dung undergoes a reaction with kaolinite and fine quartz in the soil matrix, generates insoluble silicates.

These silicates affix to discrete particles, ultimately facilitating the cohesive formation of adobe bricks [9]. Cow-dung ash is utilized alongside cow-dung, offering a highly sustainable alternative to cement. The compressive strength testing period for cow-dung ash spans 7, 28, and 56 days, consistently yielding values exceeding 3N/mm² for each replacement according to IS 4031-6 standards. Notably, at 56 days, cow-dung ash exhibited a strength of approximately 10N/mm², representing around a 10% increase. The optimal strength, approximately 25%, was attained at the best replacement percentage[10]. Integrating cow-dung into the mixture for partition walls showcases notable performance and exhibits considerable potential as an adaptive material for apartment units. The composition, consisting of 70% cow-dung and 30% organic building material, represents a straightforward yet effective solution[11].

4. Conclusions

Absolutely, extensive research, including articles, theses, and studies, reveals a multitude of benefits derived from cow-dung-based building material Certainly:

- Building materials derived from cow-dung exhibit low mass density.
- Cow-dung and cow-dung ash bricks exemplify eco-friendly alternatives, offering a reduced environmental footprint.
- Cow-dung, when employed as a building material, demonstrates hygroscopic properties, contributing to humidity control, and provides a stabilizing effect on temperature fluctuations.
- Utilizing cow-dung in construction materials avoids carbon release, resulting in a net-zero carbon emission profile.
- Constructions incorporating cow-dung-based materials demonstrate a low environmental impact, mitigating any greenhouse gas effect.
- Cow-dung bricks offer a cost-effective and sustainable option for construction.
- Material from cow-dung present notable durability and hold significant potential for application.
- Even a minor addition of cow-dung enhances the compressive strength and structural integrity of bricks.

Additionally, the outlook for cow-dung as a construction material is highly promising, as ongoing research endeavours continue to explore and expand its applications within the field.

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