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Exploring Papercrete: A Sustainable Alternative in Modern Construction.

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A B S T R A C T

Papercrete are commonly used building material all over the world for constructing walls, pavement and other elements in masonry construction. Conventional bricks are manufactured by firing of clay in high temperature kilns. Utilization of industry and agricultural waste products in the industry has been the focus of research for economic, environmental, and technical reasons. A new nature study estimates the world has 3.04 trillion trees. Almost 4 billion trees worldwide cut down each year for making paper. The construction industry has been known as one of the largest consumers of non-renewable resources. On the other hand, more waste paper ends up in landfill or dump sites than more recycled. The purpose of this research is to determine the compressive strength, water absorption capacity, efflorescence and structure of papercrete brick which determines their aptness for use as a building material. Keywords: compressive strength, water absorption capacity, efflorescence ,papercrete brick.

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I. Introduction

Papercrete was first patented in 1928 by Eric Patterson and Mike McCain, who 'invented' it independently as 'padobe' and 'fibrous cement' respectively. The pair have both contributed to the debate on potential applications and best practice for its production.

While there is a perception that the material is environmentally-friendly given its use of paper that would otherwise end up in landfill, the use of cement means it's not quite as 'green' as would be ideal.

As a building material it's enjoyed new-found popularity since the 1980s, particularly among DIY builders, with a burgeoning community online sharing applications and innovations.

PAPERCRETE

Objectives of the Study

Certainly! Here are some simple objectives for using papercrete:

1. *Sustainability:*
2. *Cost-Effectiveness:*

3. *Insulation:.*
4. *Lightweight Construction:.*
5. *Versatility:*
6. *Durability:*
7. *Ease of Use:.*
8. *Reduced Waste:.*
9. *Aesthetics:.*
10. *Fire Resistance:*

II. MATERIALS

- ***Waste paper*** *- Cardboard, newspapers, magazines, books and even junk mail are commonly used and may be added dry or pre-soaked depending on the mixing equipment being used.*
- ***Aggregate*** *- Either course or fine, typically sand, is used depending on the required strength.*
- ***Cement or clay*** *- This binds the mix together, providing strength and rigidity.*
- ***Wate***

III. Procedure

The procedure to cast bricks replacing sand in percentage wise with the paper waste is given below: 1. Materials like Cement , fine sand and papers were collected from different sources. 2. Waste papers like newspapers, from books and record papers. The collected papers cannot be used directly so these are kept in water tub with full of water for 3-4 days until the paper becomes soft and it can be made into paste or pulp form. 3. Then the total paper pulp is taken out and kept aside so that the excess water drains out from the pulp because if excess water is present then it cannot make good bonding with cement ,sand and the setting time also changes due to excess water. 4. Cement and sand(Fig 4.1) were taken in required proportions and they are mixed thoroughly to get a uniformity in the mixture. Then as per the requirement, water is added in small quantity and thoroughly mixed again. Figure 4.1: Cement and sand mixture 10 5. Into the cement and sand mixture, the paper pulp(Fig 4.2) is added in small quantities with continuous mixing. Because adding total paper pulp at a time can make the mixing difficult and cannot make the mix uniform, lumps can be formed if paper pulp is added at a time

Table 1 shows the details of mix proportions used in the study

Specimen Casting for Papercrete Bricks The paper pulp, cement, and sand are combined evenly. The sample was molded into cuboids with the following dimensions: 235 x 105 x 90 mm; picture 1 illustrates this.

IV.EXAMPLES OF PAPERCRETE CONSTRUCTION-


V. Properties of Papercrete

Papercrete has good sound absorption characteristics

. Papercrete made with some special mixes is resistant to fire, fungi, and pests of all kinds.

Papercrete blocks made with a sufficient quantity of Portland cement and sand are fire resistant

It gains inherent strength due to presence of hydrogen bonds, in microstructure of paper

. Papercrete has low cost as compared with alternative building construction material and energy absorption.

It has good fire-resistant, sound absorption and thermal insulation-

VI. ADVANTAGES OFPAPERCRETE

- *The raw materials needed to make papercrete are abundant and inexpensive.*
- *You don't need specialist equipment needed to produce the mix and form blocks and can easily make or adapt your own.*
- *Papercrete has excellent heat and sound insulating properties.*
- *It's very lightweight - far lighter than concrete*
- *It has high compressive strength.*
- *Fasteners such as screws are generally able to be used without the risk of cracking the structure.*
- *The material is very malleable and can easily be formed to make blocks, sheets or panels.*
- *Papercrete does not catch fire easily and when it does it tends to smoulder for hours. When compared to say, wood, the spread of papercrete fires tends to be confined to a smaller area and less damaging as a result. Adding more cement and mineral material increases fire resistance*

VII.DISADVANTAGES

- *As you might expect from a paper-based material, papercrete offers poor moisture resistance. If exposed to water for prolonged periods it can begin to break down. Indeed, it can easily act as a wick to extract moisture from the ground across the built structure*
- *Mould can develop if the material remains warm and moist for too long.*
- *It can easily expand and contract leading to cracks and buckling.*
- *It offers poor tensile strength. Over doors and windows additional and more traditional support (in the form of wood or concrete) is often required*

The following actions can be taken to get around some of the characteristics' limitations:

Vulnerable to termite and shape.

Deteriorates when presented to water for delayed timeframes

. Low life span.

Grows and contracts as often as possible prompting to breaks and clasping.

VIII. CONCLUSIONS

From the experimental work conducted , conclusions are as follows : 1. According to Bureau of Indian Standards (BIS):1077-1957, the minimum compressive strength of bricks is 3.50 N/mm2 .Considering the obtained results the maximum compressive strength is 6.39 N/mm2 (Composition1(1:3.25:0.75)) which is 54.77% greater than the minimum compressive strength. 2. As per the research the bricks should not absorb water more than 20%. The water absorption capacity of papercrete bricks is changing with the percentage of papercrete incorporated in the bricks. Bricks with 15% papercrete (compostion1(1:3.25:0.75))and 25% of papercrete(composition2(1:2.75:1.25)) has shown the test results within the limits (i.e., less than 20%), which is acceptable and when the percentage of papercrete increased the water absorption capacity has exceeded more than 20% which makes it not suitable. 3. Addition of papercrete up to 25% in bricks leads to well sounded bricks, further increase in percentage of papercrete doesn't give metallic sound when struck. 4. Addition of papercrete in bricks gives nill efflorescence value which is acceptable. 5. Since, papercrete brick mainly consists of waste material, it will reduce the landfill and pollution. Hence, the overall cost can be reduced as compared to conventional brick

REFERENCES

To study papercrete as a sustainable building material, here are some key references that cover various aspects of its development, properties, and applications:

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- Discusses the potential of recycling solid wastes like paper into building materials such as papercrete, contributing to sustainability.