

DEVELOPMENT AND EXPERIMENTAL STUDIES OF PAPERCRETE WALL PANELS

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ABSTRACT

Papercrete is kind of fibrous cement, made by shredding paper (old newspapers, prints, cardboards etc.) into pulp in water and adding Portland cement to it and in some cases sandy soil to be used as a additive. It gains its inherent strength due to presence of hydrogen bonds in microstructure of paper. This thick mix can then be poured into molds and cast like concrete, to make it into any desired shape and size Papercrete is a sustainable building material due to reduced amount of cement usage and recycled paper being put to good use. It has numerous advantages in construction industry, namely low carbon footprint, recycled material usage, low embodied energy, high strength to weight ratio, high thermal insulation, high sound absorption, aesthetic and cost effective. Much research is being carried out globally on the material but it is yet to be acknowledged by Indian standard practices and codes and recognized by major building material organizations in India. This paper is used to study the properties of papercrete wall panels. It is also used for studying mechanical properties and construction technology associated with papercrete wall panels.

KEYWORDS: Papercrete, Recycled, Building material.

I. INTRODUCTION

Papercrete is a construction material which consists of re-pulped paper fibre with Portland cement or clay and/or other soil added. Papercrete gets its name from the fact that most formulas use a mixture of water and cement with cellulose fibre. The fibre is usually acquired from recycled newspaper, lottery tickets and phone books. Waste paper for construction not only has the potential of waste paper recycling

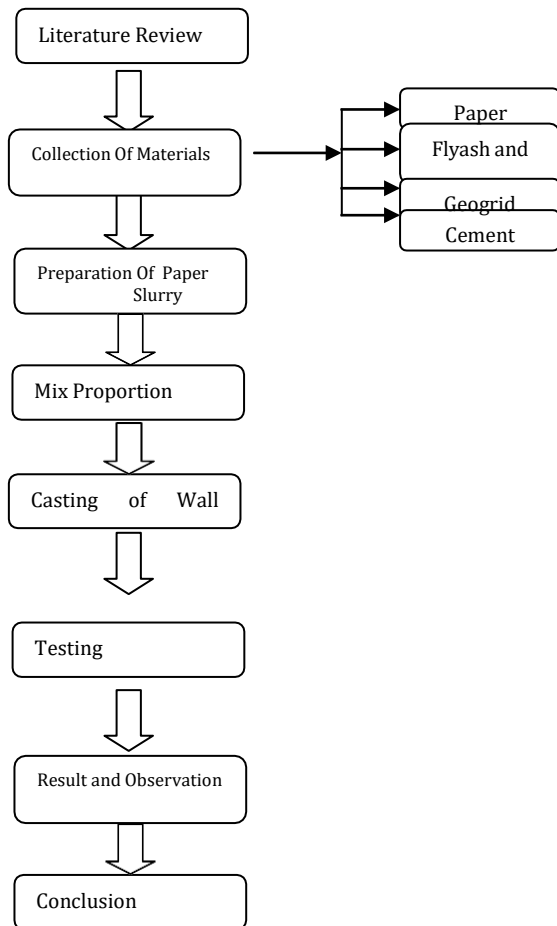
but it will also reduce the waste deposit. In construction industries, the usage of concrete increase as the demand for the production of cement is also increases and leads to releases of large quantity of greenhouse -Co₂ into the atmosphere. According to the consumption of cement in world, the requirement of Portland cement is currently exceeding 2.6 billion tons per year. Also one ton of production of cement emits the 0.8 ton of greenhouse gas of Co₂ in

atmosphere. So, by replacing Portland cement by Eco-Friendly Materials like Fly Ash and paper pulp. emission of large amount of Greenhouse Gases can be reduced.

II. SCOPE OF THE PROJECT

- To reduce the production of waste by-products in the industries and utilize it as construction material for the construction purpose.
- To avoid environmental degradation due to land fill and reduce the cost of wall panel.
- To study the behavior of Papercrete wall panels

III.METHODOLOGY



IV MATERIALS

- Mix design ratio is 1:1.5:0.5:4.
- Density of the papercrete is 1100 kg/m³
- Size of the panel is 0.4 m x 0.3 m x 0.02 m.
- Volume of the panel is 0.0024 m³.
- Weight of the paper slurry is 2kg
- Weight of cement is 0.375kg
- Weight of sand is 0.2kg
- Weight of Flyash is 0.6kg

Single panel required

- Paper pulp =2 kg
- Cement = 0.375kg
- Sand = 0.2 kg
- Fly ash =0.6 kg

Chemical Composition of Fly Ash

Component	Bituminous coal	Sub bituminous coal	Lignite coal
SiO ₂ (%)	20-60	40-60	15-45
Al ₂ O ₃ (%)	5-35	20-30	20-25
Fe ₂ O ₃ (%)	10-40	4-10	4-15
Co _o (%)	1-12	5-30	15-40
LOI((%)	0-15	0-3	0-5

V EXPERIMENTAL INVESTIGATION

Experimental Procedure

There is no specific procedure for casting the bricks and the procedure followed in this investigation was as per out convenience The mix proportion adopted was 1:15:05:4[Cement Fly Ash: River Sand: Paper Slugel. The Panels were cast in this ratio and

the tests on the panels were then conducted after 14 and 21 days.

Preparation of Paper Sludge:

The papers used were from a variety of sources Newspapers, record sheets, magazines, etc, These papers were som into small pieces and soaked in water for 3 4 days until they started degrading to paste like form. Then the papers were removed from water and ground in a mixer to obtain the paper sludge. The pulp is later taken on non absorbent plate after having the extra water squeezed out. This pulp generating procedure consumed a lot of time and was tedious. But for mass production mechanically operated tow recommended to reduce the cost mixers.

Mixing of dry ingredients

The other constituents of papercrete - cement, river sand and Fly ash were dry mixed until a uniform color was formed. In this work. mixing was manually done and the paper sludge thus obtained was the mixed with it to get the desired papererete mix. No additional water was udded unless it was essential.

Casting of panels:

The mix should be poured in the mould within 30 minutes of mixing on a table and the material was compacted using a tamping rod manually. The extra mix was removed by

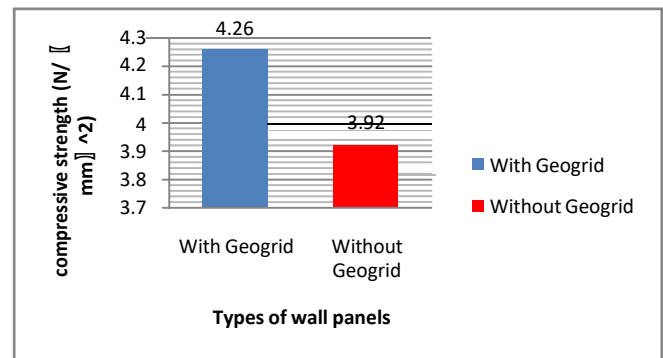
a metal strike. Two moulds were used at a time to cast the panels at a faster rate. A few panels were then sun-dried for 21 days and a few others were sun-dried for 7 days and later cured in water for the next 14 days.

Size of Panels:

- Panel should be a size of 0.4m 0.3m 0.02m
 - We choose the mix design based on our literature.collections
 - By comparing its various properties such as compressive strength, thermal conductivity and water absorption.
 - The final design mix ratio is 1:1 5:0.5:4
 - Density of papercrete 1100kg/m³.

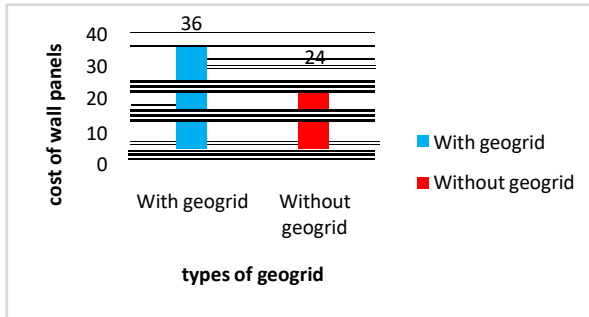
VI RESULTS

From this test, the compressive strength of wall panel, with georgic and without georgic were observed as 4.26 N/mm² and 3.92 N/mm².



Compressive Strength of Wall Panels

The cost of wall panel with georgic and without georgic is Rs.36 and Rs.24.



Cost of wall panels

VI CONCLUSION

- In this project, we successfully reduced the usage of cement and reinforcement by adding alternate material like georgic to attain desirable strength.
- We successfully utilize the waste materials like paper, fly ash etc., in the process of manufacturing new type of eco-friendly papercrete wall panels.
- To experimentally investigate by preparing and testing of papercrete wall panels under impact test, fire resistance test and water absorption test.

REFERENCES

1. Kim. Young-min, Choi.Hee-yong and Chung.Yu-gun,(2004), "A study on the properties and friendly environment efficiency charcoal concrete bricks". Architectural Institute of Korea, Vol. 20, No. 1, pp 123-130
2. S.Valls, A Yague and E.Vazquez,(2004), "Physical and mechanical properties of concrete with added dry sludge from a sewage treatment plant". Cement and Concrete Research, pp 2203-2208
3. J Pera and J Ambroise (2005) "Properties of Calcined Paper Sludge", Construction and Building Materials Vol.21, No.5 pp 405-413.
4. B J Fuller, AFafitis and J L Santamaria. (May 2006) "The Paper Alternative", ASCE Civil Engineering Vol. 75 No.5 pp. 72-77.
5. M O'Farrell and S Wild. (2006) "A New Concrete incorporating Water paper Sludge Ash (WSA)" Cement & Concrete Composites Vol.17, No.3 pp 149-158.