

# Papercrete: Utilization of waste paper

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**Abstract:** The demand for building material has rapidly increased in the last decade and with the depletion of natural resource causing a chronic shortage of building material, it has been a challenge to convert the industrial and other waste to useful building and construction material without harming the environment. As we all know emission of CO<sub>2</sub> from cement use has been an environmental concern. So, there is a need to develop alternate binding materials. This project deals with the experimental study which investigates the use of waste paper for producing a low-cost and light weight concrete.

**Keywords:** Papercrete, Waste Paper, Light Weight Concrete.

## 1. INTRODUCTION

With the increase in literacy and growing economy, the consumption of paper is increased and due to which 1600 m<sup>3</sup> paper is wasted in India per day and only 29% of waste paper is recycled in the paper industry. Waste paper constitutes of newspaper, magazine stock, junk mails, cardboard or any other type of paper. All these types of paper cannot be fully recycled. So as to utilize the waste paper which does not get recycled, it can be used for making an environment friendly construction material.

Papercrete is a recently developed construction material consisting of re-pulped paper with cement or clay. It was introduced by Eric Patterson and Mike McCain and they named the invention Padobe and Fibrous cement. It is an environment friendly material due to efficient use of waste paper and other recycled content.

## 2. METHODOLOGY

The work was carried out in different stages using different mix. Different ratios of cement, fine aggregate, paper and water proofing admixtures were considered and tested accordingly.

### 2.1 Pulp Generation

The waste paper collected for the manufacturing of papercrete cannot be used directly. It is first shredded up to a size of 10mm x 1mm (Figure.1) and immersed in water for about 3 to 5 days to convert it into a paste.

After the period, the paper is taken out from water and converted into pulp (Figure.2).



**Figure.1:** Shredded Paper.



Figure.2: Paper Pulp

### 2.2 Mixing

The pulp was then added with dry ingredients and mixed uniformly manually. After mixing, concrete blocks were casted for testing and other various tests were performed with the mixes.



Fig.3: Mixing of Ingredients

Trial Mix						
S.No.	Tag mark	Cement	Paper	Fine Agg.	Coarse Agg.	Dr. Fixit 105
1	P1	1	10%	1.5	2	20%
2	P2	1	20%	1.5	2	20%

Table 2. Mix ratio

### 3. TESTINGS AND RESULTS

#### 3.1 Slump test

It measures the consistency of fresh concrete before it hardens. It is performed to check the workability of fresh concrete (the ease with which the concrete flows).

The slump value for the papercrete samples was found out to be P1=78 mm and P2=83mm.



Fig.4: Slump of Papercrete

#### 3.2 Compaction factor test

It is done to determine the workability of fresh concrete.

The values of workability gives the degree (very low, low, medium and high) and their uses for different condition of construction activities.

The compaction factor of papercrete was found out to be P1=0.87 and P2=0.84



Fig.5 (a): Compaction Factor Apparatus



**Fig.5 (b):** Compaction Factor Cylinder

### 3.3 Water absorption test

It is used to determine the rate of sorptivity or water by the concrete specimen.

The water absorption for the papercrete was found out to be  $P1=12.13\%$  and  $P2=14.37\%$

### 3.4 Compression test

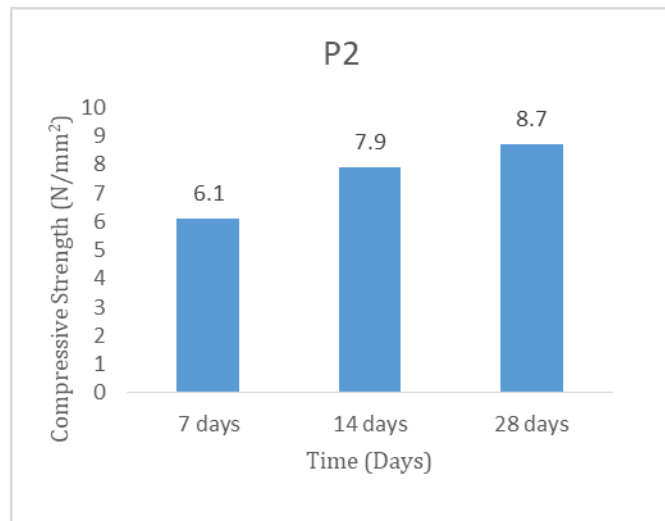
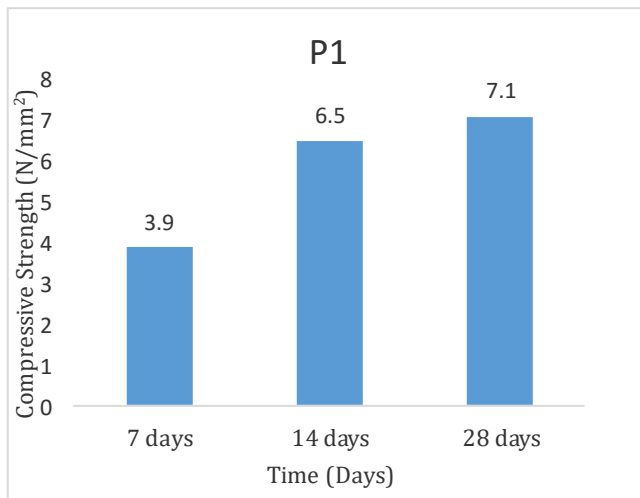
The resistance of a material to not break under compression is called compressive strength.



**Fig.6:** Molding of Bricks

Trial Mix	Compressive strength in N/mm <sup>2</sup>	
	P1	P2
7 days	3.9	6.1
14 days	6.5	7.9
28 days	7.1	8.7

**Table 2.** Compressive Strength of Mixes



### 3.5 Structure test

In this test, the concrete block is broken and examined for lumps and voids. The papercrete blocks were found out to be compact and free from defects.

### CONCLUSIONS

1. In this project we were intended to manufacture concrete by partially replacing cement with waste paper to achieve an economical and environmental friendly concrete.
2. As a fact that there are no specific guidelines and standard for manufacturing of papercrete, it is observed that it can be used in dry areas and areas with not much rainfall.
3. It can ideally be used for reduction in dead load but its application is restricted to non-load bearing walls or inner partition walls only as it take up small loads.
4. As the failure was brittle, it is ideal for areas prone to earthquakes and can be used as dampers in earthquake resistant buildings.
5. As huge amount of paper waste around the world does not get recycled and hence can be used for manufacturing of papercrete.
6. The project can be extended even further to produce more strength and durability by more significant amount of research.

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