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# Experimental Study on Papercrete Concrete

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**Abstract:** The current examination centers around using the waste materials like wastepaper and flyash into practical structure blocks and reuse the wastepaper with no ecological issue to the general climate and the society. The examination was completed to assess the strength, durability and primary properties of flyash based papercrete building blocks. Then, at that point the outcomes were contrasted and those of ordinary blocks. The strength and solidness of concrete composites containing waste paper, flyash, have been concentrated exhaustively. The papercrete used to evaluate their compressive and split tensile strength.

**Keyword**: - Papercrete,flyash, compressive strength.

## 1. INTRODUCTION

The utilization of waste generated from paper when dissolved in water to attain paper pulp which does not harm the environment and recyclable into as many times. Elastic, glass powder, mechanical waste filaments, wood sawdust squanders and limestone powder squanders in building material creation has gotten constant consideration in the course of recent years. To develop light weight material, ornamental purpose and in architectural design the papercrete paved the way to utilizing the recyclable materials in huge quantity.

## 2. LITERATURE REVIEW

Human and his activities produce a lot of wastes. At the same time, man consumes many things. Amongst the various things man consumes, building materials happen to be the largest in terms of weight being about 5 tons per capita per year, next only perhaps to water. Out of the total cost of house construction, building materials contribute 70% cost in developing countries like India. One of the construction sector's major contributions to the preservation of the environment and sustainable development is the reuse and recycling of the waste materials it generates, i.e. reducing, reusing, recycling and regenerating the residues that originate the constructive activity. This has increased the life cycle of these materials, thereby reducing the amount of waste dumping and natural resource extraction. Carter et al (1982) dealt with the incorporation of ungrounded rice husks into handmade, kiln–fired bricks. Bricks with a range of rice husk contents were prepared and then fired in either small electric kiln or a commercial Hoffman kiln. The properties like density, compressive strength, modules of rupture, water absorption and initial state of absorption were measured. They concluded from the results that it was possible to incorporate up to 50% rice husks (by volume of clay) into bricks without causing brick properties to fall outside the limits acceptable in developing countries. Weng Chin-Huang et al (2003) demonstrated suitable conditions for using dried sludge as a clay substitute to produce engineering quality of brick. The proportion of sludge in the mixture and the fixing temperature are the two key factors affecting the quality of brick.

## 3. MATERIALS

### a. Paper

Paper is the main ingredient of papercrete and so its properties depend on paper's microstructure. Wood fragments are thermo metrically or mechanically treated to dissolve the lignin binder and to free the cellulose fibers. Paper is then made by pressing the pulp to remove excess water. Paper is an anisotropic material and the quality and strength of its fibers differs depending on several factors. They are, the type of wood, the percentage of recycled paper, the amount of water in the pulp, the way of pulping (chemical or mechanical) and the speed of drying. Today half of the paper fiber utilized in current production comes from recovered fibers. Yet recovered fibers are inherently less strong and moving

  

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the pulp means orienting the fibres. Table 1 shows the properties of dry paper. The properties are determined by the Textile Department Laboratory.

**Table 1 Properties of Dry Paper**

| Properties | Values |
|---|---|
| Weight | 47 GSM |
| Thickness | 0.06 mm |
| Moisture | 7.5% |
| Bursting Strength | 168 kPa |
| Tearing resistance | 12.6 kg |
| Tensile Strength | 1.13 kg |
| Porosity | 475 mls/minute |

**b. Cement**

The cement is obtained by burning at very high temperature of mixture of calcareous and argillaceous materials. The mixture of ingredients should be intimate and they should be in correct proportion. The calcined product is known as clinker. A small quantity of gypsum is added to the clinker and it is then pulverized into very fine powder, which turns into cement. In this study, 43 grade Ordinary Portland Cement was used for the entire work. The physical properties of cement are furnished in Table 2.

**Table 2 Physical Properties of Cement**

| Properties | Results Obtained | Requirements of IS |
|---|---|---|
| Fineness (by sieve analysis) | 4.6% | Less than 10% |
| Specific Surface Area ($cm^2/g$) | 2,880 | Not less than 2250 |
| Specific gravity | 3.15 | 3.15 |
| Initial setting time (Minutes) | 32 | Not less than 30 |
| Final setting time (Minutes) | 490 | Not more than 600 |
| Compressive Strength (MPa) | 28 | 23 |

**c. Flyash**

Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coalfired power plants and together with bottom ash removed from the bottom of the furnace. It is known as coal ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO2) (both amorphous and crystalline) and calcium oxide (CaO), both being endemic ingredients in many coal-bearing rock strata. Its mineralogical composition, fine particle size and amorphous character is generally pozzolanic and in some cases also self-cementitious (Siddique Rafat 2000). Table 3 and 4 represents the chemical composition and physical properties of flyash.

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**Table 3 Chemical composition of flyash**

| Components | Percentage (%)by Weight |
|---|---|
| Silica as $SiO_2$ | 61.65 |
| Iron as $Fe_2O_3$ | 9.56 |
| Alumina as $Al_2O_3$ | 25.86 |
| Calcium as CaO | 13.78 |
| Magnesium as MgO | 2.33 |
| Titanium as $TiO_2$ | 1.09 |
| Sodium $Na_2O$ | 1.46 |
| Pottasium $K_2O$ | 1.57 |
| Sulphate as $SO_3$ | 0.62 |
| Loss on ignition | 2.38 |

**Table 4Physical properties of Flyash**

| Properties | Values |
|---|---|
| | Flyash |
| Moisture content (%) | 0.5 |
| Blaine Specific Surface Area | 29,969 |
| Specific gravity | 2.4 |
| Strength index compares with | 84 |
| Water absorption (by weight) | 13% to 15% |

**d.Fine aggregate**

The sand particle consists of small grains of silica (SiO2). It is formed by the decomposition of sand stones due to various effects of weather. According to the natural resources from which the sand is obtained, it is termed as Pit sand, River sand and Sea sand. According to the size of grains, the sand is classified as fine, coarse and gravel. The sand passing through a screen with clear openings of 1.5875 mm is known as fine sand. It is mainly used for plastering. The sand passing through a screen with clear openings of3.175 mm is known as the coarse sand. It is generally used for masonry work. The sand passing through a screen with clear openings of 7.62 mm is known as the gravel sand. It is generally used for concrete work. The coarse sand, which is used and discussed in the thesis confirms zone – II and the fineness modulus and specific gravity of sand are 2.92 and 2.52 respectively.

## 4. TRIAL MIXES

Paper is the major constituent of the mix proportions used papers with cement; fly-ash, sand, paper pulp is used as ingredients of the mix with various proportions. From these materials, mix proportion 1:2:4:4 used and evaluated compressive and split tensile strength.

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## 5. RESULTS AND DISCUSSIONS

**a. Compressive strength test:** The cube specimens of 150mm x 150mm x150mm were cast and tested in compression testing machine for 7 and 28days of curing period for different proportions of concrete mix and presented in table 5.

**Table 5: Compressive strength of papercrete concrete**

| S.No. | Mix Designation | Compressive Strength, N/mm$^2$ | |
|---|---|---|---|
| | | 7 Days | 28 Days |
| 1 | Normal papercrete | 11.91 | 17.50 |
| 2 | 30% Flyashpapercrete | 13.78 | 20.12 |
| 3 | 50% Flyashpapercrete | 11.21 | 16.60 |

**b. Split tensile strength test:** At the age of 7 and 28days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength and their strength properties is presented in table 6.

**Table 6: Split tensile strength of dolomite as partial replacement of cement in concrete**

| S.No. | Mix Designation | Split tensile strength, N/mm$^2$ | |
|---|---|---|---|
| | | 7 Days | 28 Days |
| 1 | Normal papercrete | 1.13 | 1.68 |
| | 30% Flyashpapercrete | 1.32 | 1.93 |
| 2 | 50% Flyashpapercrete | 1.07 | 1.60 |

## 6. CONCLUSION

1. The compressive strength of normal papercrete at 7 and 28 days are 11.91 and 17.50N/mm$^2$.
2. The compressive strength of 30% flyashpapercrete at 7 and 28 days are 13.78 and 20.12N/mm$^2$.
3. The compressive strength of 50% flyashpapercrete at 7 and 28 days are 11.21 and 16.60N/mm$^2$.
4. The split tensile strength of normal papercrete at 7 and 28 days are 1.13 and 1.68N/mm$^2$.
5. The split tensile strength of 30% flyash papercrete at 7 and 28 days are 1.32 and 1.93N/mm$^2$.
6. The split tensile strength of 50% flyash papercrete at 7 and 28 days are 1.07 and 1.60N/mm$^2$.

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