WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Manufacturing of Lightweight Weight Papercrete Bricks using Wastepaper

Umesh Jasrawat[1], Sumit Sharma[2], Ashwin Sharma[3], Ubaid L Hanfee[4]

[3, 4]Assistant Professor, [1,2] Student(B.E) Department of Civil Engineering, Medicaps University, Indore,Madhya Pradesh, India.ashwin.sharma@medicaps.ac.in, ubaid.hanfee@medicaps.ac.in, en18ce301090@medicaps.ac.in, en18ce301087@medicaps.ac.in.

A B S T R A C T

The primary use of structural lightweight concrete is to reduce the dead load of a concrete structure, where then allow the structural designers to reduce the size of columns, footings and other load bearing elements. The "green" concrete in this paper is defined as the concrete produced by utilizing alternative and/or recycled waste materials (such as fly ash and recycled concrete aggregates) to reduce energy consumption, environmental impact, and natural resource use.

One of major issues associated with "green" concrete is how the alternative/waste cementations and aggregate materials affect concrete properties compared with the conventional Portland cement concrete. Structural lightweight concrete mixtures can be designed to achieve similar strengths as normal weight concrete. The same is true for the mechanical and durability performance requirements. Structural light weight concrete provides a more efficient to weight ratio in structural elements. In most cases, the marginally higher cost of the lightweight concrete is offset by size reduction of structural elements. Less reinforcing steel and reduced volume of concrete, resulting lower overall cost. In buildings, structural lightweight concrete provides a higher fire rated concrete structure.

Light weight concrete is a highly thermally insulating concrete based material used for both internal and external construction. Light weight concrete's insulating capacity.

Keywords: Wastepaper, Concrete, Lightweight concrete

1. Introduction

Concrete is most largely consumed construction material worldwide. Generally it contains four basic ingredients: water, cement, fine aggregate (sand) and course aggregate but in case of light weight concrete the ingredient used are water, cement, sand and waste paper (pulp). The primary use of structural lightweight concrete is to reduce the dead load of a concrete structure, where then allow the structural designers to reduce the size of columns, footings and other load bearing elements. The "green" concrete in this paper is defined as the concrete produced by utilizing alternative and/or recycled waste materials (such as fly ash and recycled concrete aggregates) to reduce energy consumption, environmental impact, and natural resource use.

One of major issues associated with "green" concrete is how the alternative/waste cementations and aggregate materials affect concrete properties compared with the conventional Portland cement concrete. Structural lightweight concrete mixtures can be designed to achieve similar strengths as normal weight concrete. The same is true for the mechanical and durability performance requirements. Structural light weight concrete provides a more efficient to weight ratio in structural elements. In most cases, the marginally higher cost of the lightweight concrete is offset by size reduction of structural elements. Less reinforcing steel and reduced volume of concrete, resulting lower overall cost. In buildings, structural lightweight concrete provides a higher fire rated concrete structure.

Light weight concrete is a highly thermally insulating concrete based material used for both internal and external construction. Light weight concrete's insulating capacity; one of its advantages in construction is its quick and easy installation. Although the sustainability of concrete can be improved by

* *Corresponding author.* Tel.: +91 9610716793.
E-mail address: ashwin.sharma@medicaps.ac.in

using waste materials, adding SCMs or AAs could impact properties of concrete, such as compressive strength, workability, etc., which are extremely important for its applications. Also, production of concrete using waste materials is not necessarily considered sustainable unless the concrete has been proved to be durable. Concrete mixes containing various contents of the paper were prepared and basic strength characteristics such as compressive strength, splitting tensile, flexural, and water absorption were determined and compared with a control mix.
Structural lightweight concrete has an in place density(unit weight) on the order of 90 to 115 lb/ft3(1440 to 1840 kg/m3) compared to normal weight concrete with a density in the range of 140 to 150 lb/ft3 (2240 to 2400kg/m3). For structural applications the concrete strength should be greater than 2500 psi(17.0 MPa). In the case of light weight concrete we should use paper waste or paper pulp etc in the place of coarse aggregate.

Paper making generally produces a large amount of solid waste. Paper fibers can be recycled only a limited number of times before they become too short or weak to make high quality paper. It means that the broken, low quality paper fibres are separated out to become waste sludge. All the inks, dyes, coatings, pigments, staples and "stickies" (tape, plastic films, etc.) are also washed off the recycled fibers to join the waste solids. The shiny finish on glossy magazine-type paper is produced using a fine kaolin clay coating, which also becomes solid waste during recycling. This paper mill sludge consumes a large percentage of local landfill space for each and every year. Worse yet, some of the wastes are land spread on cropland as a disposal technique, raising concerns about trace contaminants building up in soil or running off into area lakes and streams. Some companies burn their sludge in incinerators, contributing to our serious air pollution problems. Papercrete was recommended to be an effective and sustainable material for the production of light weight and fire resistant hollow or solid blocks to be used to make partition walls of especially high rise building. Mix proportion was recommended for production of hollow and solid blocks using papercrete. Papercrete is a composite material comprising of Portland cement, waste paper, water and sand. It is like replacing coarse grained fraction and sand of Portland cement concrete with waste paper. Paper adobe another material sometimes referred to as a form of papercrete. Papercrete have been reported; to be a cheap alternative building construction material; to have good sound absorption and thermal insulation; to be a lightweight and fire resistant material.

2. Objectives:

- To evaluate the addition of waste paper to concrete mix, to study the effect of wastepaper on the strength of concrete, and the develop mixture proportion for concrete containing wastepaper.
- To study the physical and chemical properties of raw materials to be used for preparation of concrete mixes.
- Mix design as per Indian Standards using waste paper pulp as filler
- To prepare trial mixes for finalization of mix proportions for the study.
- To determine density, water absorption, compressive strength and fire resistance of the block containing waste paper pulp and make a comparison with control concrete.
- To develop an optimum mix proportion for eco-friendly design.
- To examine the potential of wastepaper pulp to produce an alternative composite building material.
- To investigate the effect of wastepaper pulp content and type on properties of the composite.

3. Methodology

- Comprehensive literature survey will be complete by consulting our project guide, searching on internet and reviewing journals.
- Wastepaper will be collected and will be soaked in water for further trial mixes.
- Physical and chemical properties of raw materials to be used for preparation of concrete mixes.
- Mix design as per Indian Standards using waste paper pulp as filler.
- Prepare trial mixes for finalization of mix proportions for the study.
- Observing the properties of fresh and harden concrete.
- Determining density, water absorption, compressive strength and fire resistance of the block containing waste paper pulp and make a comparison with control concrete.
- Develop an optimum mix proportion for eco-friendly design**.**

4. Experimental Work

4. 1 General specification of cement:

Class of cement: - Portland Pozzolana cement
Grade of cement: - 43 grade
Cement Bag: - 50kg of Ultratech Cement

4.2 Physical tests for cement:

There are following tests are conducted for cement

- Consistency of cement
- Fineness of cement
- Compressive strength of cement

Table 1: Observation Table

% of water	Initial reading	High penetrate
28%	0	40mm
32%	3mm	37mm
36%	5mm	35mm

Result: Standard consistency of given sample is 36%

Table 2: Apparatus

Name	Capacity/Range/ Size	Accuracy/ Least Count
Sieve	90 micron mesh	_
Balance	10 g(max.)	10 mg

Table 3: FINENESS OF CEMENT BY DRY SIEVING

Sr. No.	Sample	Initial weight	Residual weight	Fineness
1	Sample1	100gm	6.52gm	6.52%
2	Sample2	100gm	5.76gm	5.76%
3	Sample3	100gm	7.55gm	7.55%

Result: The fineness of cement of different sample are 6.52%, 5.76% and 7.55%.

4.3 Physical tests for sand:

- Specific gravity test
- Moisture content
- Sieve analysis test

As per IS: 2720 (Part 4) – 1985 – Method of test for sand

Result: The specific gravity of sand is 2.56

Table 4: Sieve analysis test

IS Sieve Size	Weight Retained	Cumulative weight	% cumulative Weightretianed	%CP passing
10mm	0	0	0	100
4.75mm	30gm	30gm	1.5	98.5
2.36mm	50gm	80gm	4	96
1.18mm	200gm	280gm	14	86

600mic	270gm	550gm	27.5	72.5
300mic	1090gm	1640gm	82	18
150mic	330gm	1970gm	98.5	1.5
Pan	30gm	2000gm		

4.4 Paper-pulp We had collected office waste from Medicaps university campus. Then using the shredding machine we had shredded the waste paper and soaked the waste paper into the water for 48 hours. After 48 hours the paper-pulp is ready to use for the preparation of trial mixes.

4.5 Tests on papercrete bricks:

4.5.1 Compressive strength test:

The water for curing should be tested 7days and 28 days. The temperature of water must be at 27+-2^{o}C

Table 5: Result of compressive strength test

Mixture	**Compressive strength(N/mm2)**	
	7days of curing	**28days of curing**
Sample1(0%of paper-pulp)	12.38	30.09
Sample2(5% of paper-pulp)	6.53	15.24
Sample3(10% of paper-pulp)	4.12	12.01

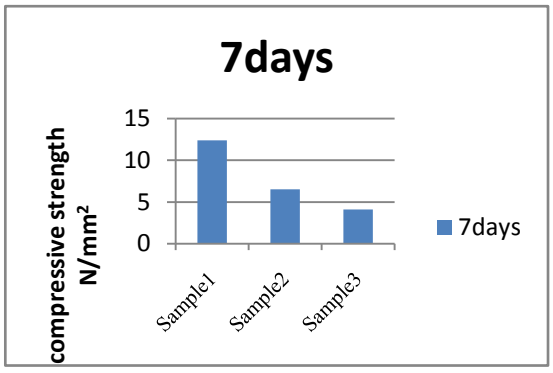

Fig. 1Compressive strength 7 Days curing

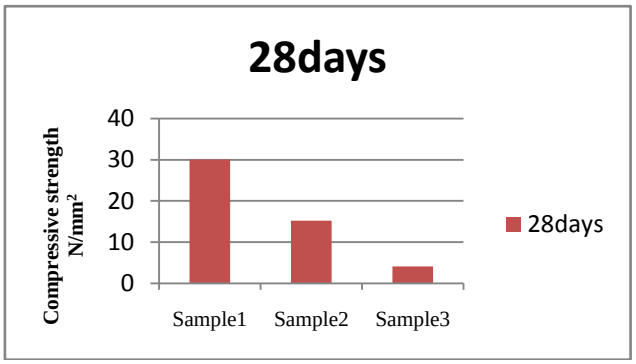

Fig. 2 Compressive strength 28 Days curing

4.5.2 Water Absorption test:

Table 6: Results of water absorption test

Sr.No.	Sample	Water absorption (in %)
1.	0% of paper-pulp	5.33
2.	5% of paper-pulp	7.14
3.	10% of paper-pulp	12.12

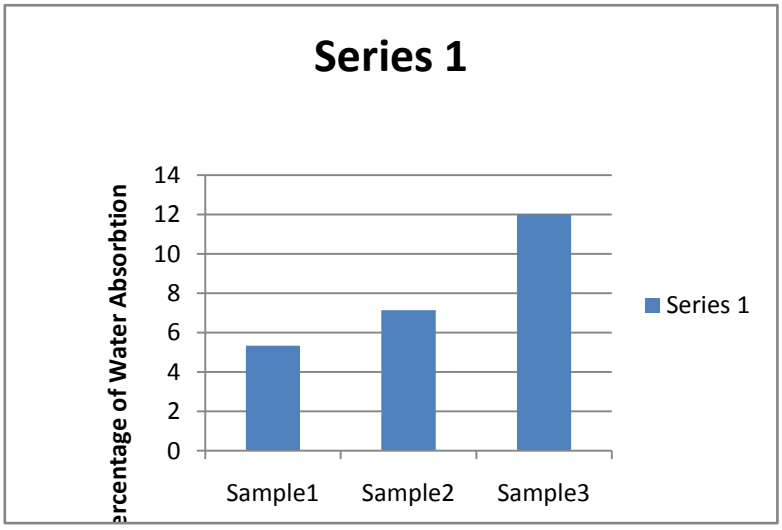

Fig. 3 Comparison of water absorption

Fig. 4 Preparation of Concrete brick mixture

Fig. 5 Adding paperpulp to concrete mixture

Fig. 6 Concrete bricks after 7 and 28 days curing

Fig. 7 Compressive strength test

5. CONCLUSION

Based from results of study it can be concluded that:

1. Each group of papercrete brick mixes containing wastepaper, compressive strength of brick decreased with the increase of the amount of wastepaper.
2. The low bulk density of papercrete indicates that they are light weight and can be used in form of either hollow or solid blocks for making walls of building, especially, high raise buildings. This property also makes papercrete arches and domes.
3. Water absorption at, 5% of paper-pulp, is 7.14% and for 10% of paper-pulp, is 12.12%. So it should not be used for external walls and near ground walls because of its high water absorption capacity. If it has to be used for external walls, the surface of the walls must be waterproof. It should be used in the partition walls to reduce the dead load.
4. In rebound hammer test the combination of both methods is the best and most reliable procedure to determine the compressive strength of concrete structure. From this method strengths of cubes are 138 kg/cm^2 and 105 kg/cm^2 respectively.
5. Hollow and solid blocks of light weight concrete for construction of partition wall in high-rise building, Green-construction/Eco-friendly construction, Low-cost housing and it reduces the dead load on the structure and good thermal insulation.

REFERENCES

[1] "Comprehensive Literature Review On Use Of Waste Product In Concrete", B.V.Bahoria, Dr.D.K.Parbat, Dr.P.B.Naganaik, Dr.U.P.Waghe, Volume 2, Issue 4, April 2013, ISSN 2319 4847.

[2] "Solid Wastes Generation In India And Their Recycling Potential In Building Materials", AsokanPappua, MohiniSaxenaa, Shyam R. Asolekar, Building And Environment 42 (2007) 2311–2320

[3] "Innovative Methodologies For The Utilisation Of Wastes From Metallurgical And Allied Industries", Sanjay Kumar, Rakesh Kumar, AmitavaBandopadhyay, Resources, Conservation And Recycling 48 (2006) 301–314

[4] "Study Of Concrete Involving Use Of Waste Paper Sludge Ash As Partial Replacement Of Cement", Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, Rafiq Ahmad, IOSR Journal Of Engineering (IOSRJEN) E-ISSN: 2250-3021, P-ISSN: 2278-8719 Vol. 3, Issue 11 (November. 2013), ||V3|| PP 06-15

[5] "Concrete Mix With Wastepaper", RitzawatyBinti, MohamadShukeri And A. Naser Abdul Ghani, 2nd INTERNATIONAL CONFERENCE ON BUILT ENVIRONMENT IN DEVELOPING COUNTRIES (ICBEDC 2008)

[6] "An Investigation Of Current Status Of "Green" Concrete In The Construction Industry", Ruoyu Jin And Qian Chen, Ph.D, 49th ASC Annual International Conference Proceedings

[7] "Experimental Investigation In Developing Low Cost Concrete From Paper Industry Waste", Engineeringcivil.Com

[8] Http://Www.Engineeringcivil.Com/Experimental-Investigation-In-Developing-Low-Cost-Concrete-From-Paper-Industrywaste.Html/Comment-Page-1

[9] "Papercrete: A Study On Green Structural Material", Bhooma Nepal And VanitaAggarwal, International Journal Of Applied Engineering Research. ISSN 0973-4562, Volume 9, Number 3 (2014) Pp. 253-260 © Research India Publications

[10] Http://Www.Ripublication.Com/Ijaer.htm

[11] "Innovative Use Of Paper Industry Waste (Hypo Sludge) In Design Mix Concrete", Prof. JayeshkumarPitroda, Dr.L.B.Zala, Dr.F.S.Umrigar, E-Issn 0976-3945

[12] "Performance Of Foamed Concrete With Waste Paper Sludge Ash (Wpsa) And Fine Recycled Concrete Aggregate (Frca) Contents", Sharipudin, S.S., Ridzuan, A.R.M, And MohdSaman, H., International Sustainability And Civil Engineering Journal Vol.1, No.2, (Dec 2012)