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A Study on Partial Replacement of Cement by Waste Paper Pulp In Concrete

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Abstract
Among different waste materials produced in different factories of India, paper industry waste, paper pulp is a noticeable one as it poses problems of health, hazards and disposal. Paper pulp is a growing problem in India as landfill spaces are used up every year causing the decrease of cultivable lands. In some cases, crop lands are used for dumping pulp which reduces fertility and a threat to human health. Disposal of pulp into rivers and canals causes severe water pollution. Some paper mill companies try to get rid of it by using incinerators to burn it causing air pollution. It is reported that waste paper pulp has pozzolanic as well as cementations properties which may be used as partial replacement of cement clinker in concrete production. This paper deals with experimental investigations to evaluate the optimum percentage of waste paper pulp to be used for making concrete.

Keywords: *Paper Pulp, Concrete, Temperature.*

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I. INTRODUCTION

At the recent days the development of our country is in the rising graph in various department like in civilization and in industry but when in industry production of materials as well as waste material are made and hence there is need to dispose of this waste material or reuse in Construction work for the minimize the cost of construction and maintained environment pollution free. Concrete is Composite construction material composed of cement, aggregate (Coarse aggregate made of gravels or crush of rocks such as limestone or granite plus fine aggregate such as sand) water, admixture as per mixed design. The concrete made with OPC is relatively strong in compression but weak in tension and tends to be brittle. These two weaknesses have limited its use. Another fundamental weakness of concrete is that cracks start as soon as concrete is placed and before it hardened properly. These cracks are major cause of weakness in concrete particularly in large on-site applications leading to subsequent failure and effect the durability. India is facing a serious challenge in disposing waste in many landfills throughout the country. The landfill situation is resulting in high disposal costs and potential environmental problems. If current trend continues, with waste production projected to grow by 5% each year, landfills would be at full capacity by 2025..

1.1.1 Problem Statement:

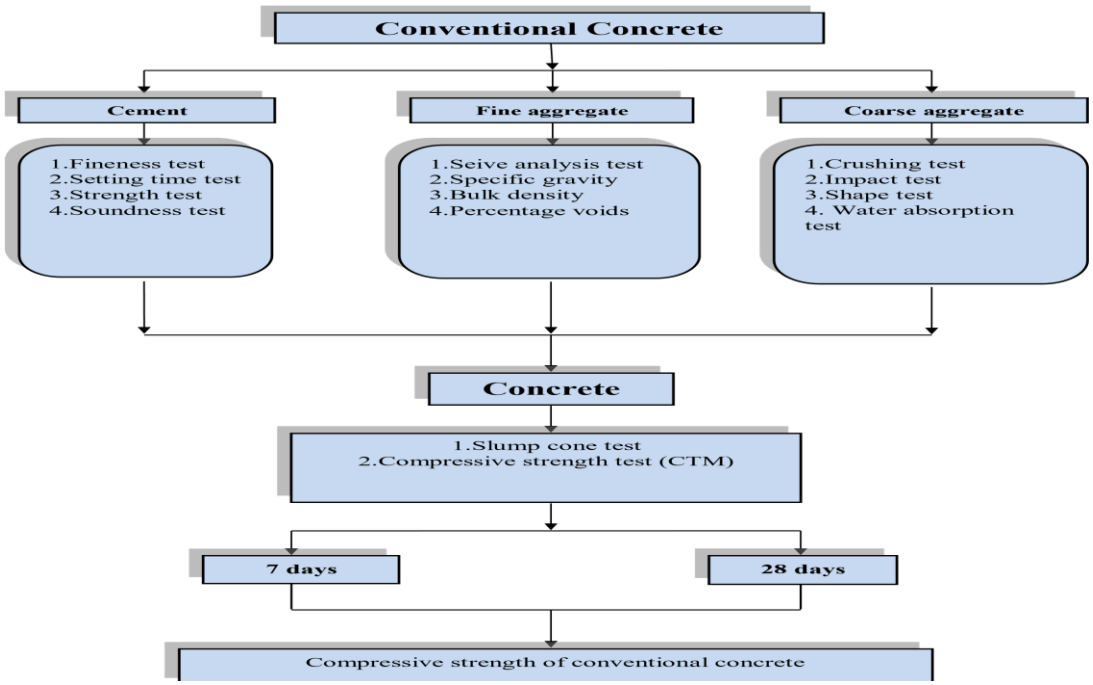
- The purpose of this research is to determine if papercrete has suitable properties to be used as construction material for homes.
- To find out if some subjective evidence about it is accurate and to determine areas of further studies.
- The parameters to be studied are compressive strength, water absorption test

1.2 Objectives

1. Investigation of utilization of paper waste as additional material in concrete mixes to be used for various construction projects, ensuring that the resulting concrete has proper compressive strength.
2. To prepare mixes containing various proportions of the paper waste.
3. To determine basic characteristics of the concrete such as compressive strength, density, water absorption and slump value.
4. Comparison of results of various characteristics with control mix.

1.2 Methodology

Table 1. Conventional concrete



1.3 Material Used & its properties

1.3.1 Cement

43-grade OPC is used throughout the experimental work and the cement used has been tested for various proportions as per IS: 4031-1988.

1.3.2. Fine Aggregate

Locally available sand, from Pravara River, is used as fine aggregate, it confirms to zone II of IS 383-1983.

1.3.3. Coarse Aggregate

Locally available crushed stone aggregates with size 5mm to 12.5 mm and of maximum size 12.5 mm are used.

1.3.4. Water

Water confirming to the requirements of IS-456: 2000 is suitable for making concrete. In the present work, available tap water is used for concreting.

1.3.5 Paper Pulp

Paper Pulp is a natural Polymer which consists of wood cellulose, which is the most abundant organic compound on the planet. Cellulose is made of units of monomer glucose (polysaccharide). Wood fragments are thermo metrically or mechanically treated to dissolve the lignin binder and to free the cellulose fibers. The Cellulose chains provide more stability and strength.

- Paper-pulp we used contained 85% of water.
- Lowest quality of paper was used, i.e. newspaper.
- Paper was soaked in water for 3 days for preparation of pulp and after that using putty mixer paper pulp was produced

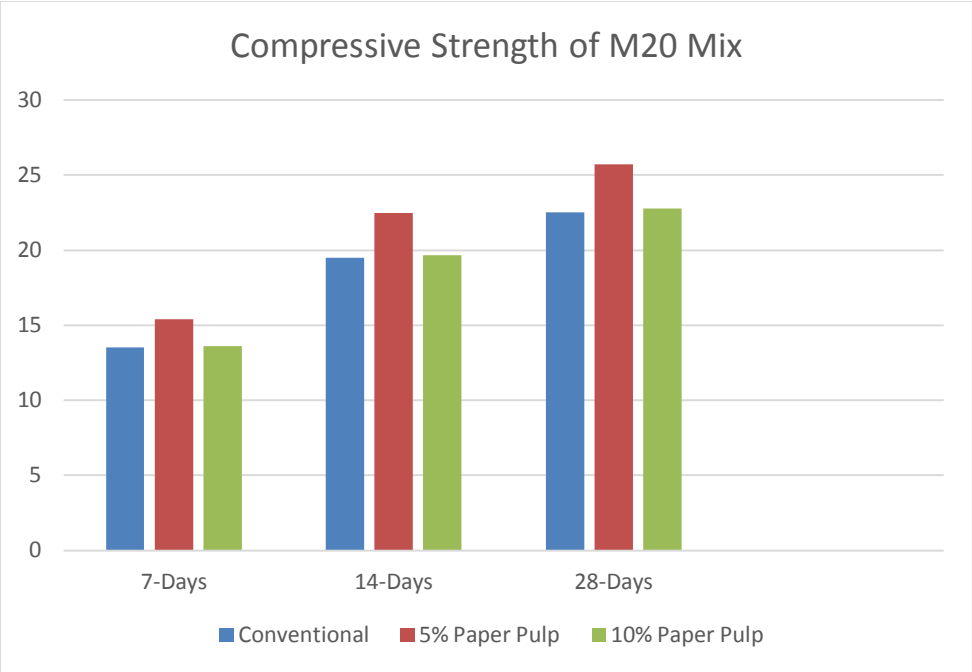
Table 1 - Elemental Analysis of Paper Pulp

	O %	Ca %	Si %	Al %	Mg %	S %	Ti %	K %	Fe %	Na %	Cu %	P %	Cl %
Paper Pulp	15.83	14.94	60.57	2.06	3.59	1.07	0.15	0.16	0.92	0.22	0.05	0.03	0.41

Table 2 - Ultimate Analysis of Paper Pulp

Sr. No.	Wt. in grams	C %	H %	N %	S %	O %
1.	420	22.7	2.5	0.3	0.4	23.6

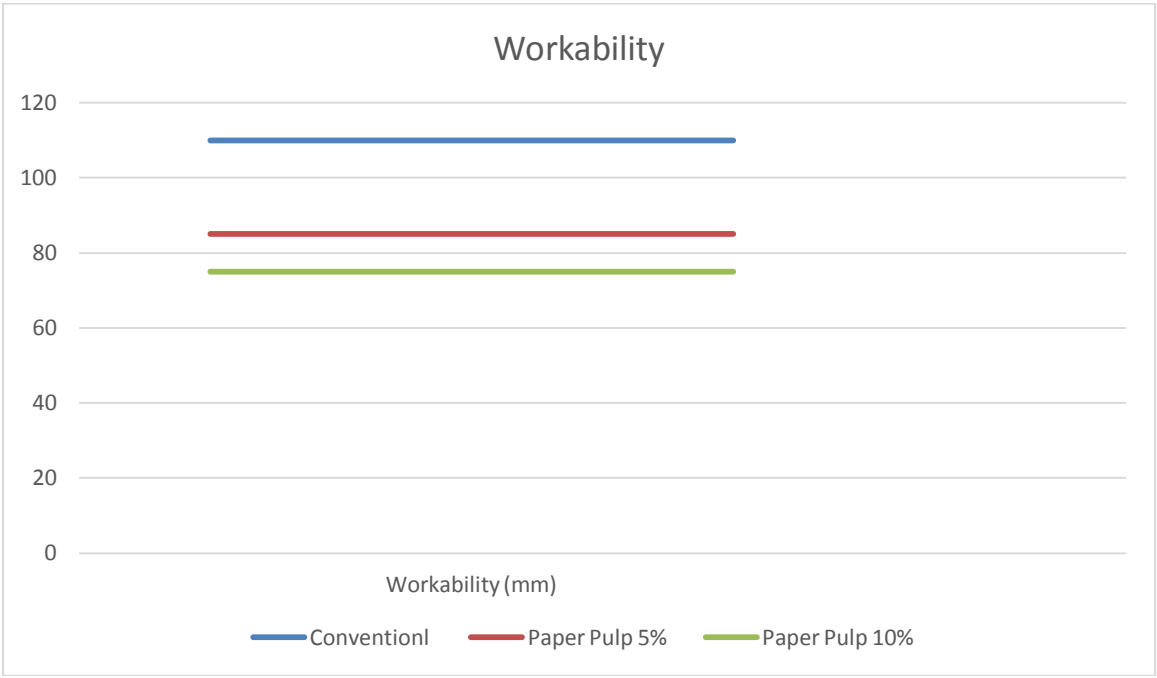
2.1 Results & Conclusion



Graph.1 Compressive Strength of M20 Grade Of Concrete

Table No: 3 Comparative Study of Compressive Strength

Serial No.	Type of concrete	Grade	7-Days	14-Days	28-Days
1.	Conventional	M20	13.52	19.57	22.54
2.	Paper Pulp (5%)	M20	15.4	22.46	25.7
3.	Paper Pulp (10%)	M20	13.6	19.67	22.76



Graph 2. Workability

Table No.4 Workability Data

Serial no.	1	2	3
Type of Concrete	Conventional Concrete	Paper Pulp (5%)	Paper Pulp (10%)
Workability (mm)	110	85	75

2.1.1 Conclusion

A) Compressive Strength.

1. From above discussion it is conclude that, compressive strength is improved by addition of paper pulp irrespective of paper pulp percentage and w/c ratio.
2. From the results we have concluded that compressive strength of Paper pulp (5%) is more than Conventional Concrete about 4 % at 7 days of age.
3. From the results we have concluded that compressive strength of Paper pulp (10%) is more than Conventional Concrete about 1.5% but it is less than Paper pulp (5%) about 3.5% at 7 days of age.
4. At the age of 14 days compressive strength of Paper pulp (5%) is more than Conventional Concrete about 6%
5. At the age of 14 days compressive strength of Paper pulp (10%) is more than Conventional Concrete about 2% but it is less than Paper pulp (5%) about 5.5%

B) Workability

1. We have Concluded from slump cone test that conventional concrete has slump more than Paper pulp (5%) & Paper pulp (10%) it is about 110mm.
2. Paper pulp (5%) Slump is more than the Paper pulp (10%) mix it is about 85mm.
3.Paper pulp (10%) has the less slump as compare to Conventional as well as Paper pulp (5%) concrete, it is about 75 mm.

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