EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERISTICS OF HIGH PERFORMANCE CONCRETE OF GRADE M35 USING PAPER PULP POWDER

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Abstract: ***Concrete is widely used material in construction around the world and cement, a major constituent of concrete is being costly and only moderately available, researches or experiments are conducted to study the variations in the strength characteristics of concrete by replacement of cement partially or fully by cheaper or locally available materials. High performance concrete was proposed and their strength characteristics were studied during the past decades. As a result varieties of cement are available in the market to suit different construction situations. Portland cement is the most important ingredient of concrete and is a versatile and relatively high cost material. Large scale production of cement is causing environmental problems on one hand and depletion of natural resources on other hand. This work examines the possibility of using waste paper sludge to produce a low cost concrete by blending various ratios of cement with paper sludge and to reduce disposal and pollution problems due to waste paper sludge. The innovative use of waste paper sludge in concrete as a supplementary cementitious material was tested as an alternative to traditional concrete. The present study reveals about the cement has been replaced by waste paper sludge accordingly as the range of 0%, 10%, 20% by weight for M35 mix. By using adequate amount of waste paper pulp and water, concrete mixtures where produced and going to compare in terms of slump and strength with the conventional concrete. The concrete specimen will going to be tested as compression test, split tensile strength and flexural strength.***.

Keywords : Paper pulp, Cement, Concrete, workability, strength

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I. INTRODUCTION

Concrete is considerably the world's largely adaptable and well-liked material produced each year in the construction. Concrete is nothing but a combination of aggregates both fine and coarse, Cement and water. Comparing to all other ingredients in concrete, cement is considered to be the expensive material. Industrial wastes are being produced per annum by chemical and agricultural process in India. These materials possess problems of disposal, health hazards and aesthetic problem. 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 fibers are separated out to become waste sludge.

Paper sludge behaves like cement because of silica and magnesium properties which improve the setting of the concrete. The quantity of sludge varies from mill to mill. The amount of sludge generated by a recycled paper mill is greatly dependent on the type of furnish being used and end product being manufactured. Paper mill sludge can be used as an alternative material applied as partial replacement of fine aggregates in manufacturing fresh concrete intended to be used for low cost housing projects. About 300 kg of sludge is produced for each tone of recycled paper. This is a relatively large volume of sludge produced each day that makes making landfill uneconomical as paper mill sludge is bulky. By adjusting the mixture to an equivalent density, concrete mixtures containing the residuals can be produced that are equal in slump and strength to a reference concrete without residuals.

II. MATERIALS

CEMENT:

In this work the Ordinary Portland Cement 53 grade was used. Cement is affine, grey powder. It is mixed with water and materials such as sand, pozzolanas to make mortar and concrete. The cement and water forms a paste that binds the other materials together.

COARSE AGGREGATE:

Locally available crushed stones confirming to graded aggregate of nominal size of 20mm as per IS 383-1970 are adopted. The physical properties of coarse aggregate like specific gravity, gradation and fineness modulus are tested**.**

FINE AGGREGATE:

Locally available river sand confirming to grading zone II of nominal size 1.18 mm as per IS 383-1970.

WATER:

The water, which is used for making concrete and for curing, should be clean and free from harmful impurities such as oil, alkali, acid, etc, In general, colorless, odourless portable fresh water was used for mixing the concrete.

PAPER PULP:

Paper pulp was collected from a factory located at Palakkad, Kerala. The waste paper pulp is dried in the sunlight and pulverized. The dried sample is kept in an oven for 800° c for 6 hours to convert the organic matter into an inorganic substance. The samples were ground through a milling machine. The grounded sample is sieved through 90 micron Indian standard sieve. The sample collected from the 90 micron sieve has been used as the replacement material for concrete.

Fig 1. Paperpulp final product

III. EXPERIMENTAL PROGRAM

Various tests for cement was carried out to find the specific gravity, fineness, Setting time and consistency. Initial and final setting time is founded with and without the replacement of paper pulp in cement by Vicat apparatus. The percentage replacement for cement by paper pulp was done in the proportion of 0, 10 and 20.

The test for coarse aggregate to check the properties of the coarse aggregate and some of the tests include the specific gravity, fineness modulus, gradation. Various tests were conducted for fine aggregate also to find out the fineness of sand, specific gravity of sand etc.

After the various tests done on the materials the concrete is prepared through batching. The selected materials are properly weighed and mixed as per the design mix proportion of 1:1.45:2.61 for M35 grade concrete, the water cement ratio used in the work is 0.45, which is obtained from the IS 10262. The concrete was cast in the form of cubes, cylinders and prisms with 0%, 10% and 20% replacement of cement by paper pulp. To find out the workability of concrete the slump test was carried out in the fresh concrete mix.

After 24 hours, the specimen is removed from the cube, cylinder and prism mould and cured. The compression, split tensile test and flexural test was carried out in 7, 14 and 28 days using universal testing machine.

IV. RESULTS AND FINDINGS

The specific gravity test conducted for cement, coarse aggregates, fine aggregates and paper pulp are carried out as per IS2386 using a parameter. Fineness test for fine and coarse aggregate is found out by I.S.SIEVES.

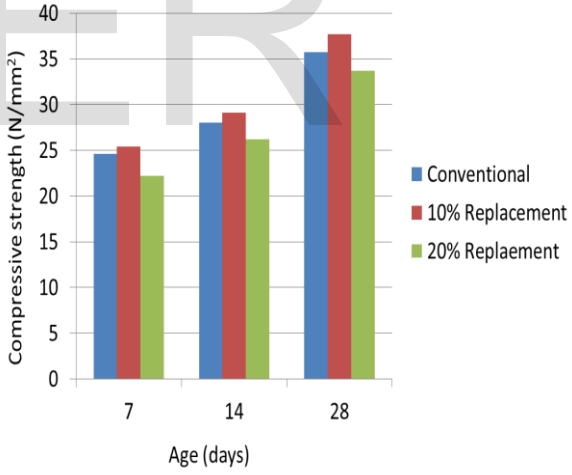
	Cement	Fine Aggregate	Coarse Aggregate	Paper Pulp
Specific gravity	3.15	2.52	2.56	2.3
Fineness	7	2.88	7.14	10

The results obtained are mentioned below

TABLE I: Test report for materials

MIX %	COMPRESSIVE STRENGTH		
	7 days (N/mm^2)	14 days (N/mm^2)	28 days (N/mm^2)
0	24.58	28.04	35.74
10	25.41	29.15	37.68
20	22.19	26.21	33.68

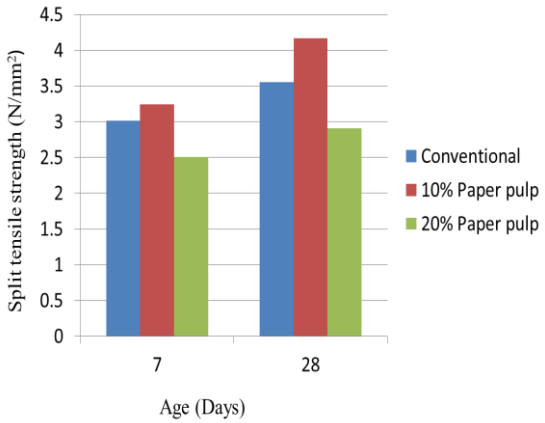
TABLE II: Compressive strength test results



The above chart represents the strength of the cube in 7 days, 14 days, and 28 days for both conventional concrete and replacement of cement in concrete by different ratios of Paper Pulp. It is observed that if the curing time increases then the strength of concrete is also increases. From the observation the 10% replacement of the Paper pulp powder gains strength more than the conventional concrete.days.

MIX %	SPLIT TENSILE STRENGTH	
	7 days (N/mm^2)	28 days (N/mm^2)
0	3.01	3.55
10	3.24	4.17
20	2.51	2.91

TABLE III: Split tensile strength test results



The above chart shows the variation in split tensile strengths for both conventional concrete and P aper pulp replacing concrete cylinders with different proportions. The result shows the ultimate strength occurs in 10% of replacement of cement by Paper pulp.

IV. CONCLUSION

This study was carried to obtain the results, test conducted on the paper pulp modified cement concrete mix, in order to ascertain the influence of paper pulp on the characteristic strength of concrete.

1. The most optimal dosage for the partial alternative of cement by paper pulp is 10%.

2. The compressive strength of concrete decreases, when the addition of dosage is more than 10%.The results show if 20% replacement of cement by paper pulp will affect the strength of concrete.

3. By doing this project we could gave a contribution to the society by making the environment more eco friendly.

4. Use of waste paper pulp in concrete can save the paper industry disposal cost and produce a “green concrete” for construction and cost can be reduced.

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