Experimental Study on Behaviour of Concrete Replaced with Water Hyacinth Ash

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***Abstract*— Concrete is the generally utilized construction material which is made out of fine and coarse aggregate together with a bond that solidifies over time. Concrete generation produces a tremendous measure of Co_2 in the environment. To decrease carbon dioxide, bond is supplanted as a supplementary cementious material in concrete. Water hyacinth develops strongly in sea-going area and copies the amount inside two weeks. The examinations have been done to assess and quality execution of water hyacinth powder mixed cement with substitution of bond in proportion's 0%, 5%,10% ,15%and 20% with M25 review concrete included with admixture of smaller scale silica and contrasted and customary cement. Compression strength test is done at 7, 14 and 28 days of curing. From the exploratory examination, it has been watched that, the performance ideal substitution of Water hyacinth to bond is 15% for M25 concrete.**

Keywords*—Concrete, Water Hyacinth, Micro Silica, Strength Results

I. INTRODUCTION

Concrete is impressively the world's to a great extent versatile all around enjoyed material delivered every year in the development. Concrete is only a mix of totals both fine and coarse, Cement and water. In all the ingredients cement is thought to be the costly material. Cement manufacturing process is one of the real makers of carbon dioxide, which is the primary driver of an Earth-wide temperature boost. Amid the assembling procedure of concrete the development of clinker can be accomplished by warming the bond at high temperature. This prompts the arrival of gigantic measures of carbon in the environment. Different research works has been completed for the cost lessening in development with a portion of the locally accessible materials as the incomplete or full trade material for concrete.

In the course of the most recent couple of decades supplementary materials like fly powder, rice husk, silica smolder, egg shell, groundnut shell, and so forth are utilized as a supplanting material. These supplementary materials have turned out to be effective in addressing the requirements of the solid in development.

Water hyacinth is a free gliding oceanic plant that develops in still or moderate moving crisp water bodies. Water hyacinth (Eichhornia crassipes), an altogether free wellspring of biomass is discovered unutilized as supplementary cementitious material. The plant comprises of long and stringy roots which might be up to three meters long and has sinewy stem. The normal length of the fiber is 1.604 mm and the normal measurement 5.5 micron. In this research work, it is utilized as a substitute of cement in concrete to evaluate the suitability and strength properties of water hyacinth as supplementary replacement material for cement.

II. SCOPE OF THE STUDY

The scope of the study is focused on the performance of concrete using water hyacinth ash as a partial replacement with 20mm nominal maximum aggregate size. In this study water hyacinth is collected from Thanjavur.

III. MATERIALS AND METHODS

A.Cement

OPC 53 Grade of Cement chettinad cement was used in this study. The following physical test are conducted in the laboratory as per IS codes.

TABLE I.PHYSICAL TEST RESULTS OF CEMENT

S.No	Physical Test	Obtained Result
1	Fineness	3%
2	Consistency	33%
3	Initial Setting Time	36min
4	Final Setting Time	265min
5	Soundness	4mm
6	Specific Gravity	3.15

B. Aggregates

The aggregate used in this study was clean river sand and crushed stone aggregate. The nominal size of coarse aggregate used is 20mm. The coarse aggregate was also tested for various properties like specific gravity, impact

strength, abrasion test, water absorption to check their suitability for the experiment.

Natural sand which is easily available and low in price was used in the work. Particles of this sand have smooth texture. Sieve analysis was done to find out fineness modulus and specific gravity for sand as per IS 383.

TABLE II.PHYSICAL TEST RESULTS OF AGGREGATES

S.No	Physical Test	Obtained Results
1	Impact Test	19.7%
2	Los Angeles Abrasion Test	10.2%
3	Specific Gravity	
	1)Coarse Aggregate	2.74
	2)Fine Aggregate	2.5
4	Water Absorption	
	1)Corse Aggregate	0.8%
	2)Fine Aggregate	0.4%

C. Water Hyacinth

Water Hyacinth were collected from waste water stagnant pool located at Thanjavur, Tamilnadu. The plants collected were throughly washed in clean running water to get rid of muddy debris and impurities. Then the sample were uniformly cut into 2 inch pieces using table knife and air dried for two weeks.

The sample was then kept in oven under 2000C for 6 hours in order to remove organic matter and for complete oxidation. Then the sample is pulverized using a milling machine. Those passing through a 150 micron sieve were used to prepare test concrete specimens. Specific gravity is found to be 2.15.

Fig.1 Water Hyacinth Ash

D. Micro Silica

It is a mineral admixture composed of very fine solid glassy spheres of silicon di-oxide(SiO_2). Micro silica particles are less than 1 micron (0.00004 inch) in diameter. Generally it is 100 times finer than average cement. It is a very fine non crystalline material produced from electric furnaces as a by-product of elemental silicon.

IV. MIX DESIGN

A design mix proportion of 1: 1.8: 2.4 (Cement:Sand:Coarse aggregate) with water/cement ratio of 0.45 value obtained from IS 10262 was used as control. All other mixes were batched with 5%,10%,15% and 20% by weight of water hyacinth to replace cement. For each mix, slump test was performed on fresh concrete. Test specimens of concrete cubes were cast in 150mm x 150mm x 150mm for compression strength test with reference to Indian standard code specification IS 516 – 1959.

A.Slump Test

This is a test commonly adopted in construction site. It is very useful in detecting the variation in the uniformity of mix of given nominal proportion. It also gives an idea of water cement ratio need for concrete to be used for different works.

TABLE III.SLUMP TEST RESULTS

S.No	%addition of WHA to concrete	Slump values (mm)
1	0	90
2	5	93
3	10	95
4	15	98
5	20	102

V. RESULT AND DISCUSSION

A. Compressive Strength of Concrete

The mix proportion of concrete cubes was 1:1.80:3.00 and water cement ratio of 0.40 was adopted. The dimensions of cubes were 150x150x150 mm. The test were performed according to IS 516-1959. All specimens will be moist cured for one day and after moist curing the specimens will be water cured for required days. Traditional curing the cubes molded with the cement concrete is subjected to curing in the water tank and then checks the strengths at the age of 7,14 and 28 days.

TABLE IV.COMPRESSIVE STRENGTH RESULTS

% addition of WHA to cement	Compressive strength of concrete (MPa) Age in days		
	7	14	28
0	16	24.5	25
5	17.2	25	25.2
10	18.35	25.2	26
15	19.7	26.8	27.12
20	13.80	19.6	22.6

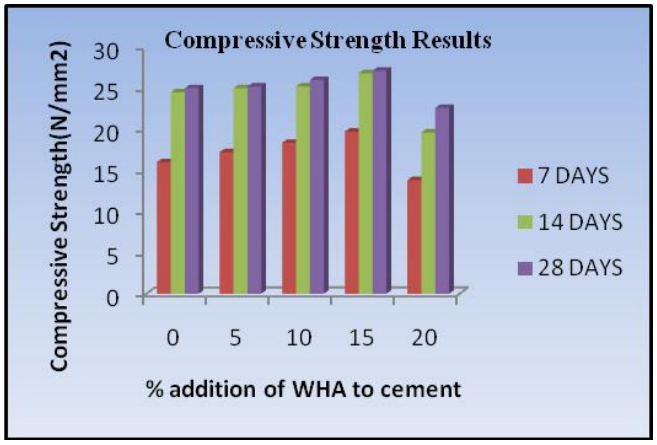

Fig.2 Compressive Strength Results

B.Tensile Strength of Concrete

Tensile strength of concrete is one of the important properties. Test is performed on cylinders to determine the strength. Cylinders were casted for 7 and 28 days and dimension of cylinders were 150mm ϕ and 300 mm height.

TABLE V.TENSILE STRENGTH RESULTS

% addition of WHA to cement	Split Tensile Strength of Concrete (MPa) Age in days	
	7	28
0	2.36	2.92
5	2.41	3.12
10	2.68	3.23
15	2.74	3.46
20	1.95	2.32

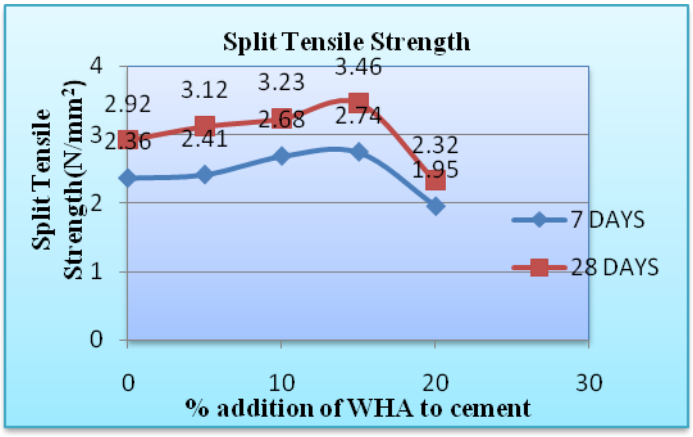

Fig.2 Split Tensile Strength Results

VI. CONCLUSION

- This investigation was completed to acquire the outcomes, test directed on the water hyacinth modified cement concrete mix is to learn the impact of WHA on characteristics strength of concrete.
- The most ideal dose for the halfway option of concrete by water hyacinth mix remains with silica admixture is observed to be 15%.
- The compressive strength of concrete cubes when the expansion of dose is over 15% the outcome demonstrates it will affect the strength of concrete.
- The workability of the mix will get increments in light of the level of substitution of water hyacinth ash.
- By utilizing the loss as filler in cement or substitution in bond will lessen natural contamination.

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