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Experimental Investigation on Water Hyacinth Ash as a Supplementary Cementing Material

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Abstract **- Concrete is an important construction material consists of cement, coarse aggregate, fine aggregate and water. Among these ingredients cement is the major constituent and it is one of the major producers of carbon dioxide into atmosphere while manufacturing cement. To reduce carbon dioxide emission cement is replaced as a supplementary cementing material by water hyacinth ash. Experimental investigations are done to evaluate the effect of water hyacinth ash in the replacement of cement. For this M30 grade of concrete is used. In which cement is replaced with water hyacinth ash by 0%, 5%, 10% and 15% by weight of cement and cast cubes and cylinders with varying proportion. And also study how it affects properties of concrete like workability, compressive strength and split tensile strength. The casted specimens are removed from the mould after 24 hours, cured and tested for 7, 14 and 28 days. The tested results are compared with ordinary concrete and water hyacinth ash replaced concrete. Finally evaluate the effect of water hyacinth ash on various strength properties of M30 concrete.**

Keywords-**Water Hyacinth, Cement, workability, compressive strength.**

I. INTRODUCTION

Concrete is an important construction material consisting of cement, aggregates and water. Among these ingredients, cement is the major producers of carbon dioxide while manufacturing clinker and contributing global warming. Hence from past years itself cement is partially or fully replaced by supplementary materials. In this experimental study cement is replaced by a supplementary cementing material called water hyacinth ash.Water hyacinth is a perennial aquatic plant and that can double its population within two weeks.

Water hyacinth is harmful to human health, aquatic life as well as environment. Water hyacinth was collected from Nadakkavu region of Ernakulam. Collected samples were washed with fresh and potable water to remove dirt and impurities. After that samples were cut in to small pieces of uniform size and dried under sunlight over few weeks. Then it was oven dried at 800^0C for 6 hours to converts its organic matter into inorganic substance. Then it was grounded into fine powder and powdered samples passing through 150 micron was used as the supplementary material for cement. This makes the concrete cost effective.

Fig. 1 Water hyacinth plant collected from Nadakkavu.

II. MATERIALS REQUIRED

1. Cement- In this research work ordinary Portland cement of 53 grade was used as binding material.
2. Coarse Aggregate- 20mm sizes of aggregates were used as coarse aggregate.
3. Fine Aggregate- M-sand was used as fine aggregate.
4. Water- Colour less, odour less fresh water was used for mixing purpose.

III. METHODOLOGY

After collecting materials, they were tested for different physical properties. Conduct specific gravity test, fineness, bulk density, crushing value etc on coarse aggregate. Fine aggregates are also tested for specific gravity, fineness and bulk density. Also conducted test on cement to find out specific gravity, fineness, standard consistency, setting time, etc.

Cement, aggregates, and water were mixed in the mix proportion of 1:1.47:2.48 for M30 grade of concrete. Water cement ratio of 0.45 was adopted. In which cement was partially replaced with 0%.5%,10%,and 15% water hyacinth ash by weight of cement. Slump test was performed to find out the workability of fresh concrete mix using slump cone. Cubes and cylinders were casted and put in the curing tank. Then it was tested for compressive strength and split tensile strength during 7,14 and 28 days of curing and compare strength variations of ordinary concrete and WHA replaced concrete.

Fig. 2 Water Hyacinth Ash.

IV. RESULTS AND FINDINGS

Table 1 Compressive Strength of Cubes

	7 days	14 days	28 days
0%	21.15	27.64	30.22
5%	21.76	27.91	30.98
10%	22.36	28.18	31.91
15%	21.02	26.13	29.51

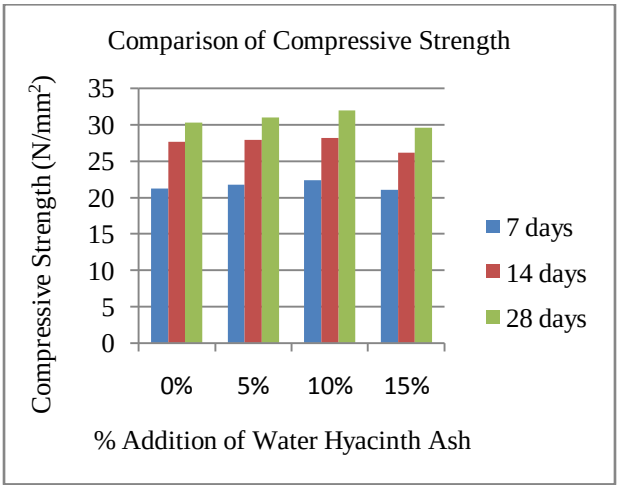

Fig 3 shows compressive strength of ordinary M 30 concrete and WHA replaced concrete.

Compressive strength of WHA replaced concrete was increased with increase in % addition of water hyacinth ash than that in conventional concrete. But this increment in compressive strength was limited to 10% replacement.ie, up to 10% replacement shows increase in compressive strength. After that each addition will results little drop in compressive strength.

Table 2 Split tensile strength of cylinders.

	7 days	14days	28days
0%	2.48	2.67	2.97
5%	2.635	2.965	3.235
10%	2.75	3.26	3.5
15%	2.35	2.95	2.97

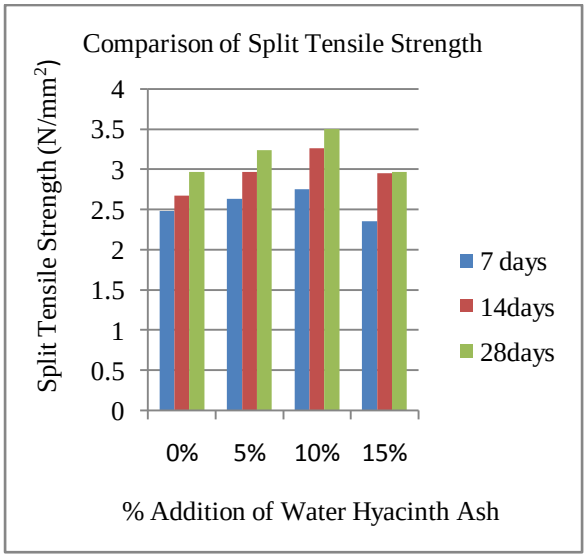

Fig.4 shows split tensile strength of ordinary M30 concrete and WHA replaced concrete.

From this graph split tensile strength of WHA concrete has increased with increase in % addition of water hyacinth ash than that of ordinary M30 concrete. Up to 10% addition of water hyacinth ash shows increment in split. tensile value and after that each addition resulted little drop in value.

V. CONCLUSIONS

- Optimum dosage of water hyacinth ash as a supplementary cementing material is 10%.
- Standard consistency of cement is increased with increase in % addition of water hyacinth ash.
- Setting time of cement is increased with increase in % addition of water hyacinth ash.
- Workability of concrete increase with increase in % addition of water hyacinth ash.

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