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RESEARCH BEHAVIOUR OF WATER HYACINTH ASH IN CONCRETE WITH A PARTIALLY REPLACED OF CEMENT

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ABSTRACT

Probably the most widely utilised building material worldwide is concrete. Portland cement is the primary component of ordinary concrete. Around the same quantity of carbon dioxide is released into the atmosphere during the manufacture of cement. Natural resources are being used up significantly in the cement industry. This has increased pressure to employ other materials to cut down on cement consumption. The water hyacinth, or Eichhornia crassipes, is a completely free biomass source that has not yet been used as an additional cementitious material. It doubles the population in two weeks by growing rapidly and richly to create a significant amount of biomass. This work will be helpful for the future application of water hyacinth ash in cement concrete since tests have been conducted to assess this bio-waste as cementitious material for the first time. The workability, compression strength, and split tensile strength performance of blended concrete with varying percentages of water hyacinth ash used to partially replace cement are the main subjects of the study. In concrete, the cement is substituted at weight percentages of 10% and 20%. Tests are conducted on concrete cubes after seven days of curing. Lastly, a comparison between the workability and strength performance of concrete blended with ash and standard concrete is made. The results of the experimental study indicate that the best substitute for cement is water hyacinth ash.

1. INTRODUCTION

The essential ingredients of concrete, which is frequently used in building, are cement, water, and aggregates. Cement is expensive in this case. Massive resource exploitation has always resulted from the manufacturing of concrete. 1.5 tonnes of limestone and clay must be mined in order to produce 1 tonne of Portland cement (civil and marine, 2007). Furthermore, throughout time, the ongoing removal of natural material, such as sand and gravel, from lakeshores, riverbeds, and other bodies of water has resulted in erosion, which in turn causes flooding and landslides. Furthermore, because there is less natural sand in the area, rainwater does not filter as well, contaminating water that is meant for human use.Every year, 1.4 tonnes of ordinary Portland cement are manufactured worldwide, accounting for 5% of greenhouse gas emissions. These issues were clearly highlighted,

contribute a substantial amount to climate change. To address the aforementioned problem in part, the ideal goal is to create a system loop that is sustainable and able to turn materials that are dumped in landfills as garbage beneficial goods in the building sector, hence protecting the environment's natural resources. Concrete is a high-tension construction material that frequently has cracks in it. linked to plastic and solidified conditions, drying shrinking and similar phenomena. Usually, the fissures appear with time and pressure to seep through the concrete, so reducing the ability to repel water and revealing from the damaging materials inside the concrete including bromine, acid sulphate, moisture, etc.

The water hyacinth (Eichhornia crassipes), which is a completely free biomass source, is discovered to be underutilised as an additional cementitious material. It doubles the population in two weeks and grows abundantly and quickly to create a significant amount of biomass. The plant has a fibrous stem and long, fibrous roots that can reach a maximum length of three metres. The fibre has an average diameter of 5.5 microns and an average length of 1.604 mm. Studies have been conducted in this study to assess this bio-waste as an additional cementitious material for the first time. There was no biological substance present in the water utilised; it was colourless, odourless, and tasteless. Water hyacinths were gathered from a stagnant waste water pool in Coimbatore, Tamil Nadu. The gathered plants were thoroughly cleaned to remove any muddy material and contaminants under running water. After that, the samples were evenly sliced with a table knife into 2-inch pieces, and they were allowed to air dry for two weeks. After that, the sample was stored in an oven below 2000C for six hours to completely oxidise and eliminate organic materials. After that, a milling machine is used to grind the sample. Test concrete specimens were prepared using those that went through a 150 micron screen.

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2. MATERIALS AND METHODS

Concrete cube test specimens measuring 150 mm by 150 mm x 150 mm were used to assess compression strength, while concrete cylinder test specimens measuring 150 mm in diameter and 300 mm in height were used to assess split tensile strength. After a full day of appropriate setting and curing, the specimens were taken out of the mould. Samples of a mix were tested for compression and split tensile strength at various curing ages of 7, 14, and 28 days. The specimens are tested using a compression testing equipment. With the aid of these outcomes, a reinforced column measuring 100 mm by 100 mm by 600 mm is cast with four 12 mm diameter rods and eight mm diameter ties spaced 100 mm apart from centre to centre for the best percentage replacement. Testing

3. RESULTS AND DISCUSSION

As per IS 2386, a pycnometer is used to do the specific gravity test, and Indian Standard Sieves are used to perform the fineness test. Below are the results.

Table 1 -Test report of the Materials

	cement	Fine Aggregate	Coarse Aggregate	Water hyacinth Ash
Specific gravity	3.15	2.74	2.74	2.12
Fineness	<150microns	Zone II	20mm	<150microns
Water absorption	-	1%	0.50%	-

Figure 1 illustrates the variance in compression strengths for concrete cubes with varying ages that were combined with water hyacinth. For every sample, it is evident that strength rose with the curing age. After seven days, control concrete increased by 76%, followed by 14 days' rise of 88%, and 28 days' gain of 99%. The water hyacinth mixed concrete increased by 50–66% on day 7, 65–70% on day 14, and 72–82% on day 28 during curing. The observation makes it evident that between 7 and 28 days, strength development is less than with cement concrete. Nonetheless, 10% OPC substitution for WHA might be regarded as the ideal limit.

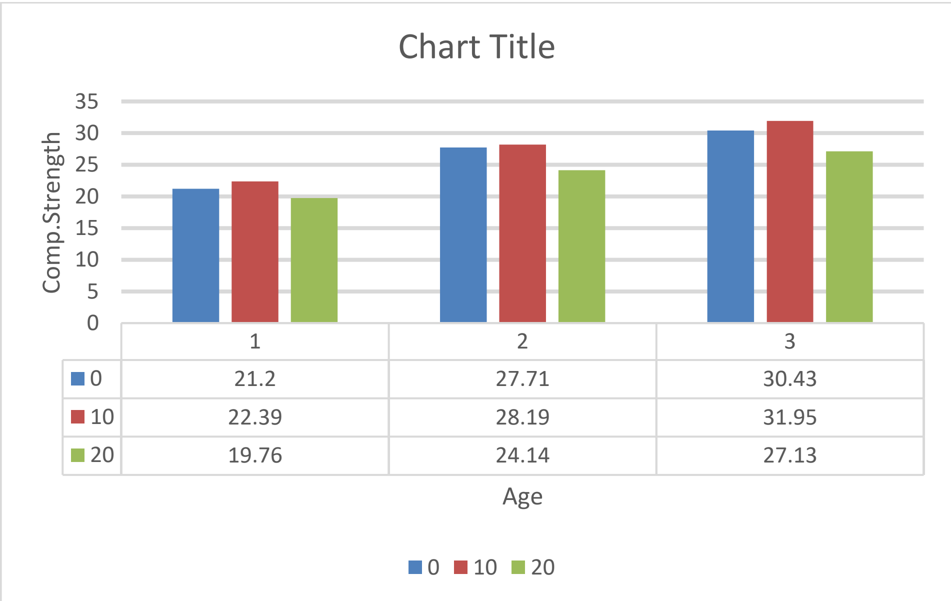

Fig. 1-compressive strength of concrete

4. CONCLUSION

- The purpose of this study was to determine the effects of water hyacinth ash on the typical strength of concrete by obtaining the results of tests done on the modified cement concrete mix.
- The ideal amount of water hyacinth ash to replace some of the cement is 10%.
- At a 20% replacement ratio of water hyacinth ash with cements, the compressive and tensile strengths of the concrete decline.
- The addition of water hyacinth ash to cement paste increases both the initial and ultimate setting times.
- The concrete's workability is becoming better when water hyacinth ash is substituted.
- The ultimate strength of the column and its cracking behaviour were greatly affected by the replacement of water hyacinth ash in the concrete mix.

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