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INVESTIGATION ON EFFECT OF WATER HYACINTH IN CONCRETE

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Abstract – *Water Hyacinth is an aquatic plant that grow vigorously in water bodies and spread all over the area in a short period. It is found in most of the countries in the world and known to be killer of aquatic life. It is found in many rivers and lakes of Kerala, which obstruct the water way itself. Water Hyacinth are usually found in two types one with long stem and broad leaves and other with short stem and small leaves. Many researches have been conducted to make use of these plants in an innovative way. Experiments were conducted to make use of these weeds as partial replacement of fine aggregate, ash of water Hyacinth as partial replacement of cement etc. Concrete one of the important construction materials use world wide composing of cement, water, fine aggregate and coarse aggregate. There is lot of environmental problems in manufacturing process of cement, the main problem being the release of greenhouse gases in large amount of CO2. In this study Water Hyacinth were prepared in different forms and concrete mixes were prepared by adding these forms in various proportions as partial replacement of Binary cement.*

Key Words: Water Hyacinth, Compressive strength, Split tensile Strength, Flexural strength.

1. INTRODUCTION

Kerala, the God's own country is blessed with lots of water bodies like lakes, rivers channel irrigation channels paddy fields, and ponds the majority of them reinvested in one or the other. The most common among them is E. crapssips, commonly known as water hyacinth. It is an aquatic plant that floats freely on slow-moving water bodies or grows in soil with stagnated water. It doubles in the area and covers the entire area within two weeks. Some of them are such as loss in biodiversity, affecting the quality of water, loss of water, agricultural imperfections, and infrastructure damage and also affecting the human health and safety as well as some aquatic species.

Concrete is the most important part of the world-wide construction industry. It is the composition of cement, water, fine aggregate and coarse aggregate mixed homogenously, cured and hardened. The most important feature of concrete is that it can be easily mould into any shape and the compressive strength is more comparing to other building materials. The main component of the concrete or the binding material is cement and is the most expensive. There is a large process in the manufacture of cement including large exploitation of natural resources. Large amount of carbon dioxide is released in the manufacture of cement which causes many environmental problems including global warming. Many locally available materials are being tested for substitute of building materials in part or full replacement which would result in cost reduction in construction works and preferably preserving the natural resources and make it environmentally friendly. This includes the locally available material like paper pulp, rice husk, silica fume, eggshell, ground nutshell, etc. the tests conducted with these materials have proven successful in all ways this supplementary material will come largely in use when the shortage of materials occurs and does not meet the needs of the construction industries.

Fig -1: Water Hyacinth Plant

2. PLANT CHARACTERISTICS

It is a perennial, tracheophyte, anchored in shallow water and free-floating herb perpetuating by suggests that of plant organ. The plant height is a hundred to two hundred metric linear unit and may grow old to height of one m forming a dense mat form. Plant having long downy roots and leaves square measure shiny inexperienced in color. It contains distinctive erect swollen bladder like petioles. Flowers having size of regarding fifty metric linear unit in diameter and striped violet or blue in color. Water orchid is found in each alkali and acidic water however the neutral water bodies possess most growth of the plant. It had been discovered that there have been no any prejudicial effects on the plant morphology in domestic waste.

3. OBJECTIVES

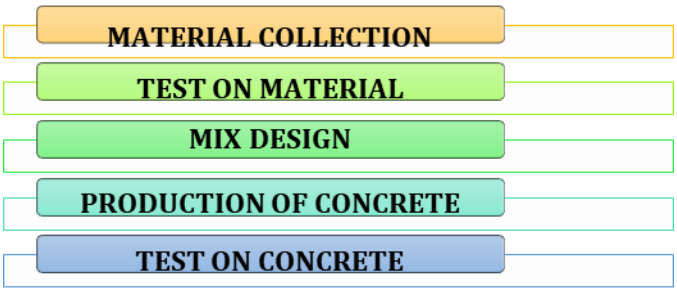
- To incorporate the utilization of and Water hyacinth ash an additional material in concrete mixes.
- To partially replace cement mixture with water hyacinth ash which is produced by oven drying of the material gives a super strength and high durable concrete.
- To explore various techniques in adoption of Water Hyacinth in concrete and to prepare mixes containing various proportions.

4. SCOPE

- Minimize the environmental problems caused by this menace, water hyacinth. It has been a wreaking havoc to the fisherman, aquatic lives and to the water bodies.
- Environmental problems are growing due to release of CO_2 in the construction process of cement.
- Shortage of conventional construction materials such as cement, gravel and sand are increasing and to preserve the natural resources.

5. METHODOLOGY

5.1. Methods



5.2. Material Used

- Cement

In this research work the Ordinary Portland cement 53 grade, confirming to IS 1269-1987 was used.

- Fine aggregate

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

- Fly ash

In this research work Class F Fly ash are used.

- Coarse aggregate

Locally available crushed blue granite stones confirming to graded aggregate of nominal size 20 mm as per IS 383-1970 are used.

- Water Hyacinth ash powder

The Water Hyacinth were taken and shredded into small pieces. The shredded samples were taken and dried in room temperature for 24 hours until the excess water in the sample had expelled. Then the sample was sun dried until the moisture content in the WH was removed and the sample acquires a homogeneous greenish color. It took 5 to 7 days depending on the sun light and heat produced. The sample was then oven heated for 24hours at 200°C so that the moisture content was completely removed and gets stiffer for pulverizing. The sample was then pulverized and sieved in IS 90 microns. The sample was then heated in oven at 300 degrees Celsius for 8 hours. The color of the sample turned black and the WH Ash was formed which was non organic and inert material.

Fig -2: Oven drying of water hyacinth

Fig -3: Water Hyacinth ash powder

5.3. TEST ON MATERIALS

Table -1: Material test result

SL. NO	NAME OF THE TEST	VALUE	PREFERABLE RANGE	IS SPECIFICATION
1	Specific Gravity Test for cement	3.14	3.10- 3.25	IS 4031:1988 (PART XI)
2	Specific Gravity Test for Fly ash	2.7	2.1-3.0	IS 3812:1981 (PART 1)
3	Specific Gravity Test for Fine aggregate	2.59	2.65-2.67	IS 2386:1963 (PART III)
4	Specific Gravity Test for Coarse aggregate	2.8	2.5-3.0	IS 2386:1963 (PART III)
5	Specific Gravity Test for WH ash	2.44	-	-
6	Fineness Test on cement	5%	<10%	IS 4031:1996 (PART 1)
7	Consistency Test on Cement	34%	26%-38%	IS 4031:1988 (PART IV)
8	Initial setting Time of cement	50 min	>30 minutes	IS 4031:1988 (PART V)

5.3.1. Inference

The above obtained values are under the preferable value of range obtained from the IS Code. Thus, they can be used for the completion of project work. Water hyacinth ash is not mentioned in any is code but it is within the range limit of the any pozzolanic construction material, hence it is safe to use.

5.4. MIX DESIGN

Table -2: Mix design

MIX DESIGN	COMPOSITION
Cement	350 Kg/m^3
Water	175 Kg/m^3
Fine aggregate	634 Kg/m^3
Coarse aggregate	1339 Kg/m^3
W/C ratio	0.44
Mix Ratio	**1: 1.67: 3.52**

5.5. CASTING OF SPECIMEN

The concrete mixes were prepared as a binary blended cement with 25% fly ash content and then containing different proportion of water hyacinth ash in various proportions the concrete were prepared through batching to create ternary blended cement. The selected materials were properly weighted and mixed as per the design mix proportion of 1:1.67:3.52 approximate to M25 grade concrete, the water cement ratio in the work is 0.44, which is obtained from IS 10262:2019.

Fig -4: Casting of concrete

Fig -5: methodology of concrete

5.5. TESTING OF SPECIMEN

The test conducted for the specimen is compressive strength test. For cube test 2 forms of specimens either cubes of 15cm X 15cm X 15cm or 10cm X 10cm x 10cm relying upon the scale of aggregate are used. for many of the works cubiform moulds of size 15cm x 15cm x 15cm are ordinarily used.

This concrete is poured within the mould and suitably tempered therefore as to not have any voids. when twenty four hours, moulds are removed, and check specimens are place in water for activity. the highest surface of those specimen ought to be created even and smooth. this can be

done by inserting cement paste and spreading smoothly on the total area of the specimen.

These specimens are tested by compression testing machine after seven days activity or 28 days activity. Load ought to be applied bit by bit at the speed of 140 kg/cm2 per minute until the Specimens fails. Load at the failure divided by space of specimen provides the compressive strength of concrete.

Fig -6: Compressive strength testing

The compressive strength is computed by the following formula

Compressive strength, F= maximum load applied/cross sectional area, A

Table -2: Compressive strength of concrete

MIX %	COMPRESSIVE STRENGTH		
	7 DAYS (N/mm^2)	14 DAYS (N/mm^2)	28 DAYS (N/mm^2)
0	21.65	24.67	30.52
1	22.32	25.13	31.04
3	23.14	25.46	32.92
5	13.77	17.12	21.11
7	10.6	11.2	13.22

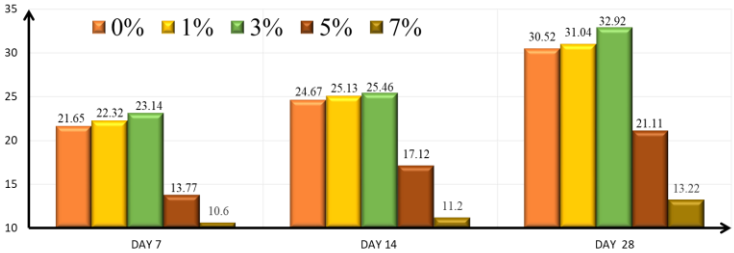


Chart -1: Graph showing compressive strength of concrete cubes at 7,14 and 28 days of curing using water hyacinth ash.

6. CONCLUSIONS

- The most optimal dosage for the partial alternative of cement by water hyacinth Ash is 3%.
- The compressive strength of concrete decreases, when the addition of dosage is more than 3%.
- The result show if 7% replacement of cement by water hyacinth Ash will affect the strength of concrete.
- Thus it is feasible to introduce water hyacinth in the production of concrete.

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