International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

Bonding Characteristics of water Hyacinth ash on Concrete by replacing cement

V. Murugesh, N. Balasundaram

Abstract*: The study explicates the experimental investigation of bonding properties of M30 grade concrete with and without replacement of cement by water hyacinth ash. The main parameters in this study are a grade of concrete, the diameter of the bar, embedded length and cause of water hyacinth ash. The study of the bonding strength of concrete is investigated by two stages. First stage concrete is cast and tested without any replacement. The Second stage, concrete is cast and tested with 10% replacement of cement by water hyacinth ash. The bars (10mm diameter and length 200 mm) are cast with concrete in the cylinder and cured for 28 days. Pull test out the experiment is carried by a universal testing machine. The results show water hyacinth ash enhances the bonding strength of concrete when compared to the normal concrete after 28 days.

Keywords: Bond strength, pull out test, water hyacinth ash powder.

I. INTRODUCTION

The Bonding strength of concrete defines the efficiency of the grip between concrete and steel. Bond strength in reinforced concrete can be carried out by both analytical and experimental through pull out method. In pull out method reinforced bar is pulled out from the concrete in the cylindrical specimen. The bond strength depends upon the concrete mix and diameter of the bar. The main important factor which affects the strength of concrete in reinforced structures is the bonding between concrete and reinforcement. When the load is acted on the reinforced elements, the structure will resist the load by its molecular bond strength and frictional force of concrete and steel. In this study, the bond strength of concrete can be analyzed with and without replacement of cement by water hyacinth ash in concrete. The exploration of innovative raw materials for the alternative to cement without affecting the properties of concrete. Water hyacinth ash can is used as the replacement material for cement and it is cost effective. The bond strength of M30 was tested by pulling out of reinforced bars from the conventional concrete and 10% cement replaced by Water hyacinth concrete. Various parameters like embedded length of steel, a diameter of bars, strength and grade mix of Concrete.

Revised Manuscript Received on 30 July 2019.
***** Correspondence Author
V. Murugesh*, Research Scholar, Department of Civil Engineering, Karpagam Academy of Higher Education, Coimbatore,(T.N.), India.
N. Balasundaram, Professor, Department of Civil Engineering, Karpagam Academy of Higher Education, Coimbatore,(T.N.), India.

II. MATERIALS AND METHODS

A. *Cement:*

OPC 43 grade cement is used for concrete. The Physical Properties are enlisted below.

Table -1: Properties of Cement

Properties of Cement	
Specific Gravity	3.10
Fineness	2 %
Consistency	32 mins
Setting time	Initial- 140 mins
	Final - 220 mins

B. *Aggregates:*

Fine aggregates and coarse aggregates are used for making concrete. Normally river sand is used as Fine aggregate and Crushed gravel of size 20 mm was used as a coarse aggregate. The Properties of Aggregates are listed below.

Table -2: Properties of Aggregates

	Fine Aggregate	Coarse Aggregate
Specific Gravity	2.60	2.82
Fineness	4.3 mm	20 mm
Water Absorption	6.2 %	8%

C. *Reinforcement steel:*

Reinforcement steel Fe500 of diameter 10mm was used for the investigation.

D. *Water Hyacinth Ash:*

Table -3: Properties of WHA

Properties of WHA	
Specific Gravity	2.44
Fineness	10 %
Water absorption	15%

Table -4: Chemical Properties of WHA

ELEMENT	CEMENT	WHA
CaO	64.236%	22.61%
Sio_2	19.29%	4.40%
Al_20_3	5.75%	2.20%
Fe_20_3	2.0841%	1.27%
Mg0	0.7296%	14.01%
$S0_3$	2.48%	3.09%
Na_20	-	0.35%
K_2O	1.0841%	14.82%

III. MIX DESIGN

Mix Design is done as per IS 10262.2009. In this study two types of mix design are used, one is conventional concrete, i.e. without replacing of cement and other is Replacement concrete, i.e. 10% of cement is replaced by water hyacinth ash. The mix design adopted for M30 concrete is 1:1.74:2.4

Table -5: Mix Design for M30

Cement	438 kg/m^3 (OPC 53)
Water	197 litre/m^3 (Normal drinking water)
Coarse aggregate	1055 kg/m (20mm Size)
Fine aggregate	764 kg/m (Zone II)
w/c	0.45
Ratio	**1:1.74:2.4**

IV. EXPERIMENTAL PROGRAM

i) Preparation Of Specimen:

Different Specimens are cast in the cylinder with and without replacement of cement by water hyacinth ash. First Cylinder mould is cleaned and dry. Concrete can be made into two types one is without replacement and others with the replacement of cement. The bar size of 10 mm diameter is embedded into a cylinder at a height of 200mm. The reinforced bar should not be placed in an inclined position. Concrete is poured into a cylinder and compacted well with the tamping rod. After 24 hours the specimen are remolded and cured in water for 28 days.

ii) Testing of Specimen:

After 28 days, the specimens are taken out from curing tank and dry for one day at room temperature. The specimen can be tested by pull out method using a universal testing machine. As per IS 2770 (Part I) – 1967, the specimen is loaded on a universal testing machine to capacity 1000 kN.

Fig -1and 2: Specimen Loaded on Universal Testing Machine

Bonding Stress can be calculated by

$$S = Pmax \times 1000/ (\pi \times D \times L)$$

Where,
S=Bonding stress (MPa) ;
Pmax= Maximum pull-out load (N)
D= Diameter of bar (mm)
L= Embedded Length (mm)
π= Constant (3.142)

Fig.3: Failure pattern (Steel rupture)

Fig.4: Failure pattern for 200 mm embedded length

The bond strength for M30 grade concrete is calculated and listed below:

Table -6: Bond strength of Concrete

Specimen	Dia of Bars (mm)	Embedded Length (mm)	Load (kN)	Bond Stress	Avg.Bond Stress
S1 (100+ 0%)	10	200	35.8	5.7	
	10	200	35.86	5.71	5.705
S2 (90+ 10%)	10	200	36.86	5.869	
	10	200	37.2	5.923	5.896

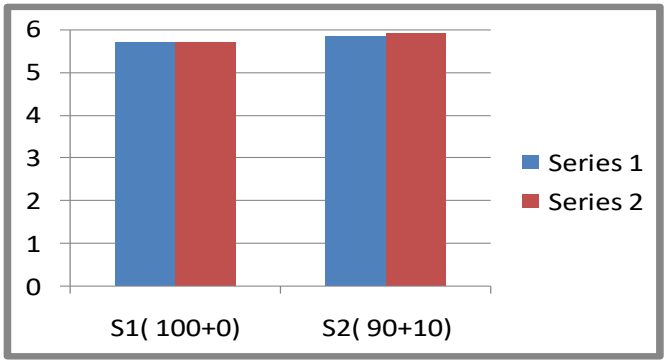

Fig -5: Graph Replacement Cement vs Bond strength

you submit your final version, after your paper has be

V. CONCLUSION

The bonding strength of Conventional concrete is less when compared to 10 % replacement cement by WHA. The combination paste of cement and water hyacinth ash with aggregates shows better bonding property than conventional concrete. It will conclude that water hyacinth ash will enhance the property of cement and concrete.

REFERENCES

1. Rami H Haddad and Linda G. Shannis, "Post-fire behavior of bond between high strength pozzolanic concrete and reinforcing steel- Part A" *Construction and Building Materials*, vol.18, March 2004, pp 425–435.
2. Mahdi Arezoumandi, Michael H. Wolfe and Jeffery S. Volz, "A comparative study of the bond strength of reinforcing steel in high-volume fly ash concrete and conventional concrete" *Construction and Building Materials*, Vol. 40, Dec. 2012, pp 919–924.
3. Ismaeel H, Musa Albarwary and James H. Haido, " Bond strength of concrete with the reinforcement bars polluted with oil" *European Scientific Journal*, vol. 9, No. 6, Feb. 2013, pp 1857- 7431.
4. *IS 516*:1959, Methods of tests for strength of concrete, *BIS*, New Delhi.
5. IS 2770 (Part I) – 1967, Methods of Testing Bond in Reinforced concrete, *BIS*, New Delhi.
6. IS 10262:2009 Mix Design