International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 03, March-2017

An Experimental Investigation on Strength of Concrete Made with Cow Dung Ash and Glass Fibre

Sruthy B
M.Tech Scholar, Civil engineering
Sree Narayana Institute of Technology
Adoor, Kerala

Anisha G Krishnan
Assistant professor, Civil engineering
Sree Narayan Institute of Technology
Adoor, Kerala

Gibi Miriyam Mathew
M Tech Scholar, Civil Engineering
Sree Narayana Institute of Technology
Adoor, Kerala

Sruthi G Raj
M Tech Scholar, Civil Engineering
Sree Narayana Institute of Technology
Adoor, Kerala

***Abstract*-The consumption of cement in concrete industries has been increasing day by day to fulfil the needs of infrastructure due to growing population, industrialization and urbanization. The production of cement poses environmental problems due to emission of gaseous pollutants. Cow dung is used as fuel for the domestic purpose, which generates solid waste as ash. This paper presents the result on the study for the use of Cow Dung Ash (CDA) as partial replacement of cement in production of concrete. This replacement was designed to study the effects of adding Cow Dung Ash (CDA) in various percentages by weight (6%, 8%, 10%, 12% and 14%) of cement. To strengthen the CDA concrete and making it more durable 0.5% glass fibre is being added, as it is an economically strong material, have excellent flexural strength, crack resistance and can also be used as an alternate material for concrete construction. The M25 mix design for the proposed concrete mix is calculated. Results showed that up to 8% replacement of cement by cow dung ash there was an increase in compressive strength. The experimental work was carried out with M sand confirming to zone I as fine aggregate in concrete.**

Keywords- Cow dung ash (CDA); Cement; Compressive strength; Ordinary Portland Cement (OPC);Glass fibre

I. INTRODUCTION

Cement is the main binder in the production of concrete, mortar, sandcrete blocks and other cement products, is very expensive particularly in developing countries. Concrete is the most widely used man made construction material in civil engineering. The consumption of cement in concrete industries has been increasing day by day to fulfil the needs of infrastructure due to growing population and industrialization. Governments and organizations are working together to find solutions for a greener future, while prospective zero carbon sustainable cities are already underway. The production of cement poses environmental problems due to emission of gaseous pollutants. Due to emissions of poisonous gases like CO_2, NO etc by cement production company they have depleted the natural environment, they have caused environment pollution and global warming due to the depletion of ozone layer. Production of Portland cement emits CO_2 into the atmosphere. Therefore there is a need to search for supplementary cementitious materials for utilization as partial substitute for cement. Several researchers have used different materials like sawdust ash, rice husk ash, fly ash, granulated blast furnace slag, as partial replacement of cement in concrete. Waste is the one of the challenge to dispose and manage. Cow dung is the undigested residue of plant matter which comes from cows gut. In cow dung nitrogen, calcium, carbon, potassium, and phosphorus have a high content of about 10-15 kg cow dung is produce by a cow in a day, which contain about 28% water in fresh state, 34% of cow dung become ash when it is burned. According to a survey of 2012 there are about 51.2 crore cattle in India. Cow dung was habitually used in concrete and so one may suppose there were particular benefits in its inclusion. The cement was replaced by cow dung ash as 6%, 8%, 10%, 12% and 14%. To strengthen the CDA concrete and making it more durable glass fibre is being added, as it is an economically strong material, have excellent flexural strength, crack resistance and can also be used as an alternate material for concrete construction.

II. SCOPE OF THE STUDY

- Examine the effectiveness of using CDA as partial replacement of cement and a study will be conducted on strength parameter.
- Necessity of consumption of the waste material for manufacturing of sustainable concrete for construction.
- The material is locally available and that can also reduce the cost of producing concrete.
- The cement industry is held responsible for some of the carbon-dioxide emission which contributes the global warming. To overcome these problems, in this project work CDA is used as supplementary cementitious material.

III. OBJECTIVE OF THE STUDY

- To investigate the compressive strength of concrete with CDA to that of normal concrete.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 03, March-2017

- To prepare high strength, eco-friendly and cost effective concrete.
- To evaluate the significance and importance of consumption of the waste material for manufacturing of sustainable concrete for construction.

IV. MATERIAL USED

The materials used in this study included ordinary Portland cement, fine aggregate (manufactured sand), coarse aggregate, mixing water, super plasticizers and glass fibres.

A. Cement

The most common cement used in general concrete construction when there is no exposure to sulphates in the soil or groundwater. Ordinary Portland cement 53 grade was used throughout the study. The standard consistency, setting time and specific gravity were tested in the laboratory. All the tests were carried out in accordance with procedure laid down in IS 12269 – 1987.

B. Fine aggregate

Fine aggregate are basically sands won from the land or the marine environment. Fine aggregates are the materials that pass through 4.75 mm IS sieve. Manufactured sand (M sand) was used as fine aggregate. Manufactured sand is a substitute of river for construction purposes sand produced from hard granite stone by crushing. The tests such as specific gravity and gradation were carried out to determine the physical properties of fine aggregate.

C. Coarse aggregate

Locally available crushed stone aggregate of 20 mm size was used throughout the experimental study. The tests such as specific gravity and gradation were carried out to determine the physical properties of coarse aggregate. The coarse aggregate is chosen by shape as per IS 2386(Part I) 1963, surface texture characteristics of aggregate is classified as in IS 383-1970.

D. Water

This is the least expensive but most important ingredient of concrete. The water which is used for making concrete should be clean and free from harmful impurities such as oil, alkali, acid, etc. Potable water was used for the experiment.

E. Cow dung ash

The cow dung is exposed to sunlight to dry in order to have dung cakes which is then subjected to burning after it is dried to have the cow dung ash which is obtained in black colour. It is also made sure that the ash stored in an air tied container to protect from absorbing moisture.

Fig 1: Cow dung ash

F. Glass fibre

The glass fibres used are of glass fibre with modulus of elasticity 74GPa, Filament diameter 14 microns, specific gravity 2.68, length 12 mm and having the aspect ratio of 857.1. The number of fibres per kg is 132 million fibres.

Fig 2: Glass fibre

G. Super plasticizer

To impart additional workability a super plasticizer CERAPLAST 300 was used. The super plasticizer was added 0.5 to 0.7 % by weight of cement to all mixes.

V. METHODOLOGY

A. Specific gravity test

The specific gravity is normally defined as the ratio between the weight of a given volume of material and weight of an equal volume of water. Specific gravity of cement, fine aggregate and coarse aggregate are tested.

B. Sieve analysis

Sieve analysis is done as per IS 2386 (Part I)-1963. The first step involves arranging the IS sieves in the order of4.75mm-2.36mm-1.18mm-600µ-300µ150µ. 2kgs of fine aggregate is taken and placed on the top most sieves. Sieving is done for fifteen minutes and weight retained on each IS sieve is found.

C. Consistency of cement

Ordinary Portland cement of grade 53 was used in the casting of the specimens. Consistency limit test is done to determine the standard water requirement for setting time, the test was done under standard condition as mention in IS: 4031-1988.

D. Bulk Density, Void Ratio and Porosity of Fine and Coarse Aggregate

Bulk density is the density of dry aggregate. This is required to determine the amount of aggregate in concrete mix. Container having 3L capacity, tamping rod and weighing balance were used for determining the bulk density, void ratio and porosity of aggregate.

E. Initial and final setting time

Vicat apparatus with 1mm square needle was used for initial setting time test and another needle with annular attachment was used for final setting time test of Ordinary Portland cement. In this test 400 gm of cement was mixed with 0.85 times the percentage of water as determined in the consistency test. The time required to penetrate the needle to a depth of 5 mm from the bottom of the mould was noted as initial setting time and the time required to make an impression on the test block was noted as final setting time.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 03, March-2017

F. Workability test

Slump test and compaction factor test were conducted on fresh concrete to determine the workability of concrete as per IS 456 – 2000.

G. Compressive strength test

Compressive strength of concrete is a measure of its ability to resist static load.7, 14 and 28 day compressive strength test were conducted on three specimens having size 150x150 mm and the average strength was taken as the cube compressive strength of concrete.

VI. RESULT

A. Test on cement

TABLE I: PROPERTIES OF CEMENT

Sl.No	Properties	Result
1	Fineness	1.133%
2	Specific Gravity	3.15
3	Consistency	29%

B. Test on aggregate

TABLE II: PROPERTIES OF AGGREGATE

Sl.No	Physical Properties	Result
1	Specific gravity of Fine Aggregate	2.26
2	Specific gravity of coarse aggregate	2.35
3	Bulk density of coarse aggregate	1.574
4	Void ratio of coarse aggregate	0.8
5	Porosity of coarse aggregate	0.445

C. Test on fresh concrete

TABLE III: WORKABILITY TEST ON FRESH CONCRETE

Sl No:	Grade	Percentage of CDA replacemnt	% of glass fibre added	Workability test	
				Slump test	*Compaction test*
1	M25	0%	0%	82	0.91
2		6%	0.5%	81	0.90
3		8%		81	0.90
4		10%		77	0.87
5		12%		75	0.84
6		14%		72	0.84

D. Obtained compressive strength

TABLE IV: COMPRESSIVE STRENGTH

Percentage of replacement	Percentage of fibe added	Compressive strength after 7 Days (N/mm^2)	Compressive strength after 14 days (N/mm^2)	Compressive strength after 28days (N/mm^2)
0%	0.5%	22.66	24.88	27.14
6%		23.55	24	26.22
8%		25.77	27.11	30.22
10%		21.77	23.11	25.33
12%		17.33	19.11	20
14%		14.66	17.33	19.55

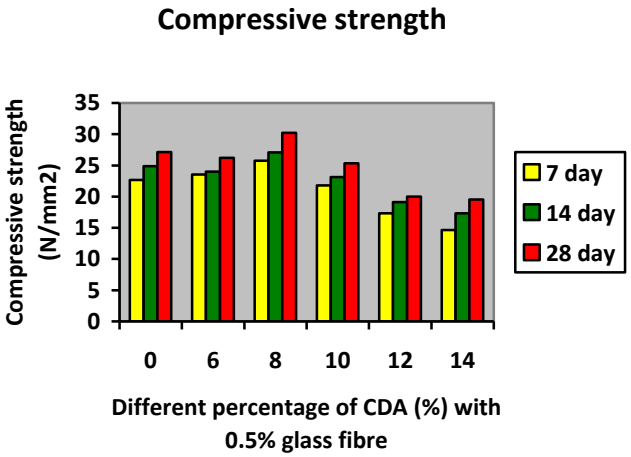

Fig 3: Relationship between compressive strength and various percentage of CDA

Fig 4: Compressive strength testing

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 03, March-2017

Fig 5: Casted specimen

VII. CONCLUSION

From the experimental investigation the following observation are drawn.

- The replacement of cement with cow dung ash 6% and 8% leads to increase in compressive strength whereas the percentage replacement of 10% leads to decrease in compressive strength.
- Maximum strength is attained at 8% CDA and 0.5% of glass fibre, after that strength starts decreasing thus the optimum content is 8%.
- The workability of concrete had been found to be decrease with increase of cow dung ash and glass fibre.
- Workability of concrete after use of a super plasticizer can achieve the desired workability.
- The concrete preparation is for eco-friendly and cost effective. These materials are locally available and they can also reduce the cost of producing concrete.
- The Cow Dung Ash has an advantage that offers lightness of weight that makes it useful construction material.

ACKNOWLEDGMENT

We would like to acknowledge Dr. P. G. Bhaskaran Nair, P.G Dean, Sree Narayana Institute of Technology, for his valuable suggestions, encouragement, and finding. We would like to record our gratefulness to my family and friends for their help and support for completion of project. I thank God Almighty for his grace throughout the work.

REFERENCES

[1] Deshmukh S.H, Bhusari J. P, Zende A. M "Effect of Glass Fibres on Ordinary Portland cement Concrete". IOSR Journal of Engineering, June 2012.

[2] Duna Samson, Omoniyi Tope Moses "Investigating the Pozzolanic Potentials of Cowdung Ash in Cement Paste and Mortars" Civil and Environmental Research, ISSN 2224-5790, Vol.6, No.8, 2014.

[3] Jitender Kumar Dhaka, Surendra Roy "Utilization of fly ash and cow dung ash as partial replacement of cement in concrete" International Journal of Civil and Structural Engineering, vol.6, 2015.

[4] Ojedokun, O. Y., Adeniran, A. A., Raheem, S. B. and Aderinto, S. J " Cow dung ash as partial replacement of cementing material in the production of concrete", British Journal of Applied Science & Technology,vol.4(24), pp 3445-3454,2014.

[5] Omoniyi, T., Duna, S. and Mohammed, A., "Compressive strength characteristic of cow dung ash blended cement concrete" International Journal of Scientific & Engineering Research,vol.5, pp 770-776,2014.

[6] Rayaprolu, V. S. R. P. K. and Raju, P. P, "Incorporation of cow dung ash to mortar and concrete" International Journal of Engineering Research and Applications, vol.2, pp. 580-585, 2012.