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PERFORMANCE OF COW DUNG POWDER ON COMPRESSIVE STRENGTH OF BLENDED CONCRETE

Ayeni I. S.*[1], Adekanmi J. S.[1] and Abodunrin David Olumuyiwa[2]

[1]Civil Engineering Department, The Federal Polytechnic Ado-Ekiti, Ekiti State, Nigeria.
[2]Department of Agricultural Education, College of Education, Ikere Ekiti.

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***Corresponding Author**
Ayeni I. S.
Civil Engineering Department, The Federal Polytechnic Ado-Ekiti, Ekiti State, Nigeria.

ABSTRACT

This research work aims at using cow dung powder (CDP) as partial replacement for cement in concrete production. The percentage replacements were varied from 0%, 5%, 10%, 15%, 20%, 25% and 30% with water cement ratio varied from 0.54, 0.57, 0.60, 0.64, 0.68, 0.72 and 0.77. The mixing ratio was 1:2:4. The result of chemical analysis conducted on cow dung powder shows that it is pozzolanic. The Workability result gives 20mm, 15mm, 15mm, 13mm, 11mm, 9mm, and 8mm for CDP with 0%, 5%, 10%, 15%, 20%, 25% and 30% replacements. Concrete cubes of size 150 x 150 x 150mm were cast, cured and tested at different maturing ages of 7, 14, 28, 56 and 112 days. The compressive strength results for 0%, 5%, 10%, 15%, 20%, 25% and 30% replacement for CDP varied from 15.12-32.44, 12.02-26.64, 8.72-22.48, 6.12-20.26, 5.09-18.03, 4.81-15.03, and 4.67-14.36 (N/mm^2) respectively. The 20% replacement meets strength requirement (17N/mm^2) for light weight concrete.

KEYWORDS: Cow dung powder, concrete, chemical analysis, pozzolanic, workability, compressive strength

INTRODUCTION

The global use of concrete is second only to water. As the demand for concrete as a construction material increases, so also the demand for Portland cement. It is estimated that the production of cement will increase from about from 1.5 billion tons in 1995 to 2.2 billion tons in 2010 (Malhotra, et al, 2014). Concrete is widely used as construction composite materials for various types of structures due to its durability. For a long time it was considered to be very durable material requiring a little or no maintenance (Vignesh et al., 2014).Concrete can be a strong durable building material that can be formed into many varied shapes and sizes ranging from a simple rectangular column, to a slender curved dome or shell, if the constituent materials are carefully selected (Olanitori, 2006). Many factors can adversely affect the durability of concrete structures such as poor design, poor supervision, impurities (such as clay/silt, debris), etc. (Olanitori and Olotuah, 2005). Concrete is a construction materials which consists of the mixture of fine aggregates, coarse aggregates, cement which is proportionally mixed with certain percentage of water (Ganiron, 2014). The relevance of concrete in virtually all Civil Engineering practices and building construction cannot be over-emphasized (Adewuyi & Adegoke, 2008). However, the construction industries rely heavily on conventional materials such as cement, granite, and sand for production of concrete (Oyedepo, Oluwajana & Akande, 2014). In some areas, the demand for these conventional materials is higher than supply (Divakar, 2007). Engineers are continually pushing the limits with the help of innovative chemical admixtures and supplementary cementitious materials (SCM). Supplementary cementitious materials are often incorporated in the concrete mix to reduce cement contents, improve workability, increase strength, enhance durability and ultimately reduce cost (Omoniyi, Duna & Mohammed, 2014). Materials such as Cow Dung Ash, Cow dung powder, Fly Ash, Slag, and Silica Fume, can be used as partial replacement for Cementing material (Omoniyi, Duna & Mohammed, 2014). Nonetheless, accumulation of unmanaged wastes especially in developing countries has resulted in an increasing environmental problem (Elinwa et al 2011). However, the increase in popularity of using environmental friendly, light weight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting environment as well as maintain the materials requirements affirmed in the standards.

MATERIALS AND METHOD

Materials

The following materials were obtained and used for the research work:

- **Cow Dung Powder (CDP)**

The cow dung was obtained from cow excreta which was sun dried and grounded to powder form like cement. The grounded cow dung powder particles were sieved through 90microns. The percentage replacements for cement by cow dung were varied from 0%, 5%, 10%, 15%, 20%, 25%, and 30%.

- **Cement**

The dangote brand of ordinary Portland cement grade 42.5 conforming to BS EN 197-1 (2000) requirement was used.

- **Water**

The water used for this research work was portable, clean, and free from any visible impurities conforming to BS EN 1008, (2002) requirement.

- **Fine aggregate**

The fine aggregate used for this research work was river sand retained on a 600 microns sieve. These particles bond very well and increase the strength of the concrete. They are the filler materials.

- **Coarse aggregate**

This comprises of natural and crushed stones. The coarse aggregate used in this study is granite of size 20mm. Particles with larger sizes cause reduction in strength of concrete.

Methods

The following tests were conducted for the purpose of this research work

Chemical Analysis: Chemical analysis of a representative sample of the cow dung Powder was carried out using XRF Spectrometer (AAS Buck Scientific 210VGP & Flame Photometer Fp 902PG) to ascertain the chemical constituents. The test was conducted at the Chemistry/Quality control laboratory of Afe Babalola University Ado-Ekiti, Ekiti State, Nigeria.

Slump: This is the most widely used test for determining the workability of concrete. It is a measure of the resistance of concrete to flow under its weight. It was conducted at Concrete Laboratory of Civil Engineering Department, Federal Polytechnic, Ado Ekiti, Nigeria.

Compressive strength: The compressive strength of concrete is one of the most important and useful properties of concrete. The primary purpose for design concrete is to resist compressive stresses in structural members. Hence it is the role of a concrete designer to specify the expected characteristics strength of concrete / mix proportion to enable it resist external force. The concrete cubes of sizes 150mm x 150mm x 150mm were cast by partial replacing cement with cow dung powder with percentage replacement of 0%, 5%, 10%, 15%, 20%, 25%, and 30% and cured by immersion in clean and portable water. These cubes were tested at maturing ages varying from 7days, 14days, 28days, 56days and 112days. The crushing test was carried out on an electric crushing machine (made in Italy by control Milano with serial no CR 2-029) with maximum load capacity of 1500KN. The crushing was done at Concrete Laboratory, Civil Engineering Department, Afe Babalola University Ado-Ekiti, Ekiti State, Nigeria.

RESULT AND DISCUSSION

Chemical analysis result

Table 1: Chemical composition of cow dung powder (CDP)

OXIDES (%)	Mn_2O_5	SiO_2	CaO	MgO	Al_2O_3	K_2O	Na_2O	P_2O_5	SO_3	Fe_2O_3
CDP	1.47	77.16	15.96	2.06	6.29	6.00	1.33	0.92	1.03	2.88

The chemical composition cow dung powder reveals the presence of similar oxides to those of cement and other supplementary cementing materials which implies that it can be used as a cement replacement material if used in the right proportion. The sum of the oxides of silicon, Iron and Aluminum in cow dung powder (CDP) is 77.16% which exceed the 70% minimum specified by ASTMC618-12 for raw or calcined pozzolana (class N).The combined alkali (Na_2O+ K_2O) percentage of 7.33 for cow dung powder is low and thus reduces the possibility of the destructive aggregate alkali reaction which causes disintegration of concrete. Also, high alkalis percentage has been observed to affect the setting time and the rate of strength gain. One other interesting chemical present is sulphur trioxide (SO_3). The SO_3 in CDP 1.03% which is below the 4% maximum specified by ASTM C618-12 which shows the tendency for improved durability and prevent unsoundness of the paste.

Slump Values

Table 2: Slump values for cow dung ash and cow dung powder.

Percentage replacement	CDP replacement slump result (mm)
0%	20
5%	15
10%	15

15%	13
20%	11
25%	9
30%	8

Table 2 and Figure 1 show that as the percentage replacement is increasing, the workability is decreasing.

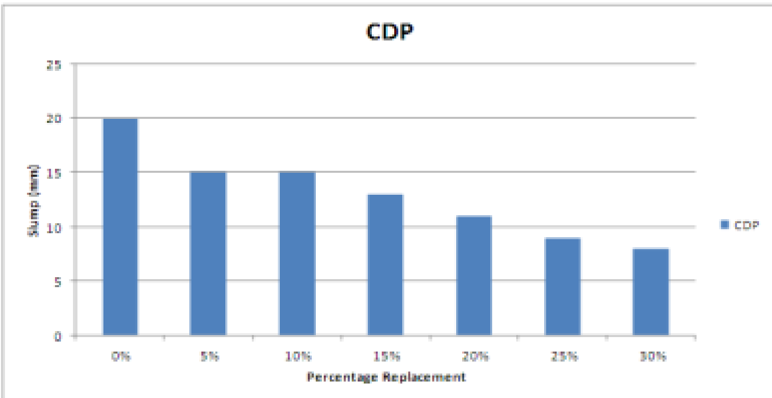

Figure 1: Bar chart for slump test of concrete produced using cow dung ash and cow dung powder.

Table 3: Result of compressive strength test performed on concrete produced with cow dung powder as partial replacement for cement.

Percentage of replacement	Compressive strength				
	7 Days (N/mm^2)	14 Days (N/mm^2)	28 Days (N/mm^2)	56 Days (N/mm^2)	112 Days (N/mm^2)
0%	15.12	17.57	27.04	30.01	32.44
5%	12.02	13.95	24.17	25.65	26.64
10%	8.72	11.10	19.43	21.67	22.48
15%	6.12	8.02	11.41	15.00	20.26
20%	5.09	6.39	9.68	16.22	18.03
25%	4.81	5.69	8.57	15.33	15.05
30%	4.67	5.17	7.26	13.47	14.36

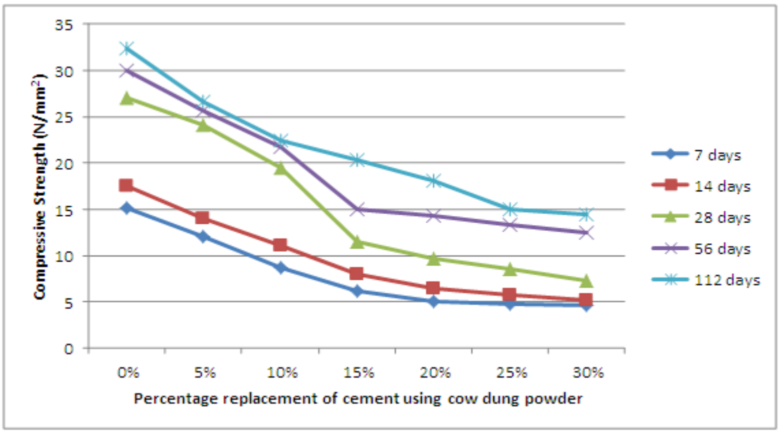

Figure 2: Graph of compressive strength against percentage of replacement of Cow Dung Powder.

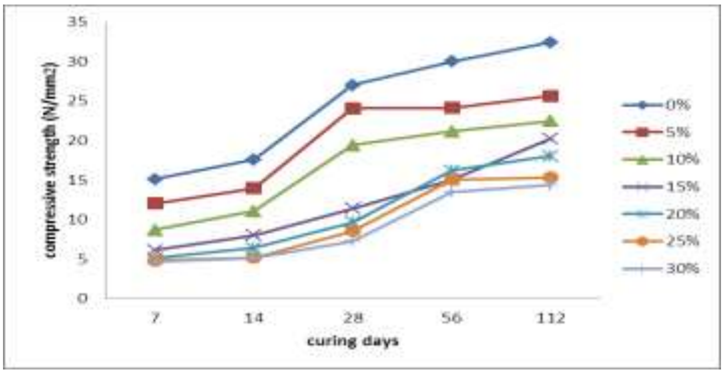

Figure 3: graph of compressive strength against curing days for concrete produced with CDP.

From figures 2 and 3, it is shown that as percentage replacement is increasing compressive strength is decreasing. Also, as the curing days was increasing, the compressive strength was increasing.

CONCLUSION

From the results obtained from the study (test), it is obvious that the compressive strength of concrete increases with increase in curing days and decreased as percentage replacement increases**.** The Compressive strength value obtained at 20% replacement CDP was found to conform to the minimum requirement of 17N/mm^2 for light weight concrete after 28days of curing. The workability decreases with increase in percentage replacement, this requires more water to have a workable concrete.

RECOMMENDATION

CDP can be a useful pozzolana up to 20% replacement for cement in concrete production. The use of Cow dung ash reduces cost of materials for production of concrete, it also reduces the amount of cement used in concrete production and invariable reduces total tonnes of cement produced this leads to reduction in carbon monoxide emission that depletes the ozone layer. The use of CDP should be encouraged for the following reasons; reduction is cost of building, reduction in energy consumption, reduction in CO_2 emission.

REFERNCES

1. Adewuyi A. P. and Adegoke T. Exploratory Study of Periwinkle Shell as Coarse aggregates in Concrete Works. Journal of Applied Sciences Research, 2008; 4(12); 1678-1681.
2. British Standard. Specification for Aggregates from Natural Sources for Concrete (BS 882), 1992.
3. Divakar Y., Manjunath S. and Aswath M. U. (2012) Experimental Investigation on Behavior of Concrete with the Use of Granite Fines. International Journal of Advance Engineering Research, 2012; 1(4).
4. Elinwa A. U. and Abdulkadir S. Charactering Saw dust Ash for Use as an Inhibitor for Reinforcement, 2011.
5. Ganiron J. Effect of Sawdust as Fine Aggregate in Concrete Mixture for Building Construction" International Journal of Advanced Science and Technology, 2014; 63; 73-82.
6. Malhotra, V.M. Making concrete greener with fly ash, Indian Concrete Journal, 1999; 609 – 614.
7. Omoniyi T., Duna S. and Mohammed A. Compressive Strength of Characteristic of Cow dung ash blended cement concrete (IJSER), 2014; 5(7): 770-776.
8. Olanitori L. M. Mitigating the Effect of Clay Content of Sand on Concrete Strength. 31st Conference on Our World in Concrete and Structures, Singapore, 2006.
9. Olanitori L. M. and Olotuah A. O. Effects of Clayey Impurities in Sand on the Crushing Strength of Concrete (A Case Study of Sand in Akure Metropolis, Ondo State, Nigeria), 30th Conference on Our World in Concrete and Structures, Singapore, 2005.
10. Oyedepo, O.J., Oluwajana S.D. and Akande S. P. Investigation of Properties of Concrete Using Sawdust as Partial Replacement for Sand. Department of Civil Engineering, Federal University of Technology, Akure, Nigeria, 2014.
11. Vignesh K., Raja K., Marimuthus P., and Chandrasekaran K. (2014): Multiresponse Optimization on AISI 410 and EN 19 Steel in turning operation using Grey relation analysis (IJMERR), 2014; 3(2).