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Assessment of Cassava Peel Ash Blended Cement in Concrete Production

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ABSTRACT
This study examines the feasibility of using Cassava Peel Ash Blended Cement (CPABC) as material in concrete production. The cassava peel ash was used to replace cement, by 0%, 3%, 6%, 9%, and 12% by weight of cementitious materials. The experimental results indicate that blended cement containing ash derived from cassava waste shows satisfactory setting times and soundness test results. Workability of concrete incorporating the ash is categorized as good, and no segregation was observed. The effects of ash addition on concrete densities and water absorption are insignificant. Compressive strength of the concrete increase with curing age and reduces with increase in CPABC content.The strength of the concrete with 3 % CPABC was found to be next to the control batches. Cassava peel ash blended cementhas greater usability potential in concrete.

Key words: Cassava Peel Ash, Blended Cement, Eco-friendly Concrete

I. INTRODUCTION

The provision of housing for all is a major problem facing both the rural and urban dwellers, particularly in the developing countries. This is majorly as a result of rising cost of building materials especially cement. The use of some form of cement to bind together stones, gravel and other materials has been practiced from very early times. Cement is the most common type of cement in general use around the world and it has been experiencing a steady rise in cost due to high demand for the material (Caijun, 2001; Bentur, 2002).

Also, cement productions have been reported to have adverse environmental impacts at all stages of the process. During the manufacturing of cement, green house gases are generated and released through two mechanisms: fossil fuel burning for energy consumption by the kiln and the calcinations process of clinker production. It had been found out that for every tonne of cement produced, between 1 tonne and 1.25 tonnes of carbon dioxide are released into the atmosphere (ASTM, 2007; Neville, 2008). This has resulted into air pollution in the form of dust and gas. Other environmental pollution from cement production include noise and vibration when operating machinery and during blasting in quarries (Bentur, 2002).

The goal, then, is to specify blended cements or innovative cement technologies that either significantly increase hydraulic efficiency, or directly replace cement with pozzolans. Tremendous efforts have been made by various researchers on positive exploitation of the efficient use of various agricultural and industrial by products (Ettu, et al., 2013; Ogunbode and Akanmu, 2012).The use of agro-waste such as fly ash, blast furnace slag and rice husk ash amongst others in blended cement as partial replacement of cement offer clear environmental advantages since they do not require production of clinker calcinations and mining of all sorts (Mohd and Abdullah, 2009; Adesiyan, 2007; Salau and Olonade, 2011).

Based on this background, the paper therefore aimed to investigate Cassava Peel Ash Blended Cement (CPABC) on compressive strength of concrete with the view of enhancing an eco-friendly construction material for sustainable infrastructural development of the nation.

II. MATERIALS AND METHODS

2.1 Materials

Cassava peel ash, cement, granite and sharp sand were the materials used in the study. ThecassavapeelwasobtainedfromSiunmarket, ObafemiOwodeLocalGovernment Area, Ogun State, Nigeria. The sand and granite of size 5-16 mm and 16-27 mm respectively were purchased from local suppliers.

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2.2 **Methods**

Cassava peel was open burnt with maximum temperature of burning of 650^{o}C to obtain the ash. Mechanical analysis was performed on the cassava peel ash sample and the percentage retained on a sieve No. 300 (opening 300 µm) was used in the study. The cement was partially replaced withcassava peel ash at the dosage of 0-12% by weight of cementitious materials. Concrete mix ratio of 1:2:4 by weight was used. The cast specimens were covered with a polyurethane sheet. They were demoulded at the age of 1 day and cured in water until the test ages.

Plate 1: CPA Sample

Plate 2: Testing CPA Concrete

III. RESULTS

3.1 Particle Size Distribution of Cassava Peel Ash

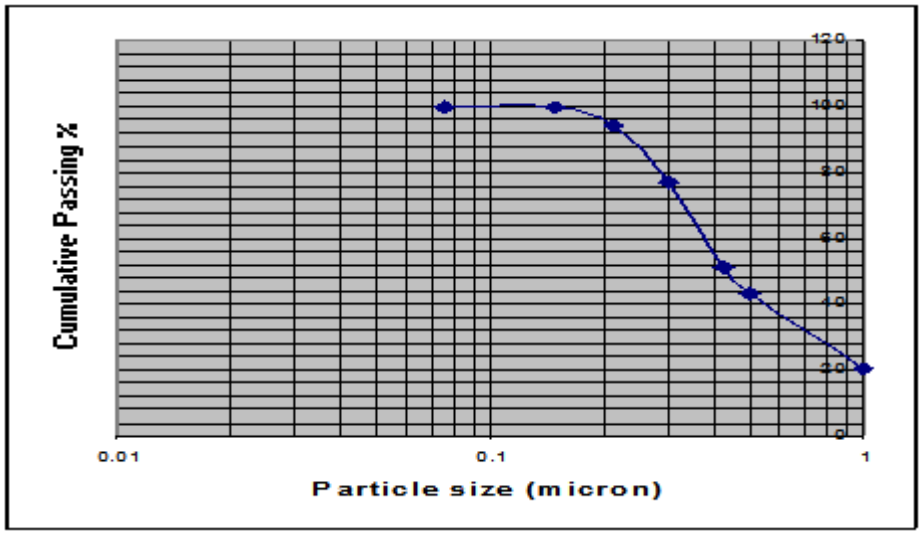

Figure 1: Particle Size distribution of CPA

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3.2 Compressive strength of CPABC concrete

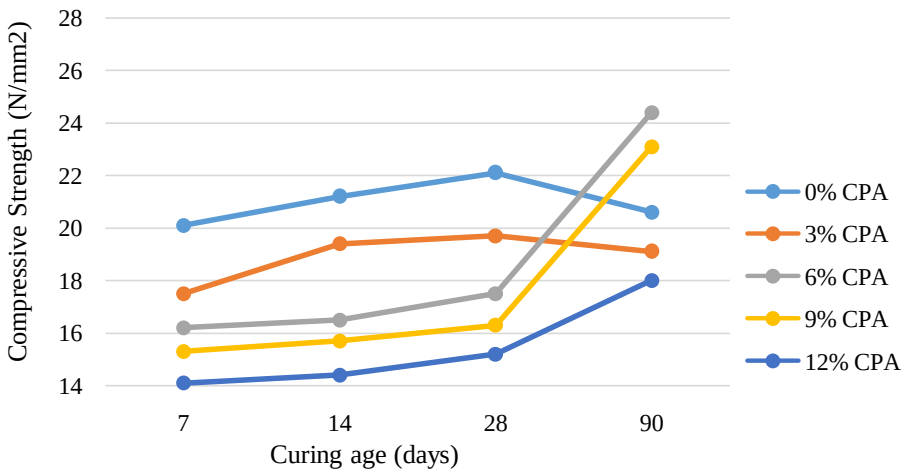

Fig. 2: Compressive strength of CPABC Concrete

IV. DISCUSSION

Figure 2 shows the variation of compressive strength of CPABC concrete with time. The experimental results indicate that blended cement containing ash derived from oil-palm waste shows satisfactory setting times and soundness test results. Workability of concrete incorporating the ash is categorized as good, and no segregation was observed. This agreed with previous studies (Singhet al., 2000; Siddique, 2008).

The effects of ash addition on concrete densities and water absorption are insignificant. Compressive strength of the concrete was noticed to be increasing with time and decreasing as CPA ashcontent increases. However, the strength of the concrete with 3 % CPABC concrete was found to be next to the control batches, which could still be used if appropriate technology is developed.This agreed with previous studies (Ettu, et al., 2013; Ogunbode and Akanmu, 2012).

V. CONCLUSION

The experimental results, it can be deduced that CPABC actually contains the main element of cement in appreciable percentage. The results of the compressive strength, the strength of the concrete with 3 % CPABC was found to be next to the control batches indicate that CPABC which indicate that CPABChad usability potential in concrete production.

VI. RECOMMENDATION

Based on the findings from this study, the following suggestions are made:

1. Further studies should be on 0-5% replacement of cement with CPABC and in steps of 1%.
2. Concrete blended with CPABC content should be cured beyond 90 days, to improve its strength.

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