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STUDY ON WASTE BRICK TILES AS ADMIXTURE IN CONCRETE

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ABSTRACT

Industrialization in developing countries has led to an unavoidable increase in the production of waste materials in the construction sector and subsequent accumulation of uncontrollable waste. In this article, milledwaste brick tiles were studied as an admixture in concrete. We performed various levels of milledwaste brick tiles powder as admixture varying from 0 to 20%, followed by some tests to examine the compressive strength of concrete. To achieve the aim of the study, waste brick tiles were milled into powder form and was used as admixture at different percentage levels (0%, to 20%) by weight of the cement.Portland Limestone Cement (PLC) of grade 42.5 was used in producing 150mm x 150mm x 150mm concrete cubes. River sand were used as fine aggregate and crushed stone as coarse aggregates of nominal size 14mm were used in this work. Potable mixing water was used throughout this study. The waste brick tilesused for this study wassource from a construction site along Opolo-Elebele Road, Yenagoa, Bayelsa State, Nigeria.Sixty cubes of 150 mm × 150 mm × 150 mm were produced for this study, twelve were control (0%) and twelve cubes for each percentage addition (5%, 10%,15%, and 20%) of ground waste brick tiles powder. Cube samples were cured for7, 14, 21 and 28 days. The compressive strengths of the specimens were computed by dividing the maximum failure load attained during the test by the cross-sectional area of the specimen. The cubes were tested 7, 14, 21 and 28 days. Study results showed that with the addition of waste brick tiles powder 5 to 20% gave noticeably greater compressive strength than 0%, (control specimens) at 28 days age except 5%. At 21 days, concrete cubes with 10 - 15% waste brick tiles powder addition gave average compressive strengths than the control strength. 5% waste brick tiles powder addition reduces the strength at 21days, while 5-15% waste Brick Tiles powder addition increases the strength at 7 and 14 days.Based on the study results, it is recommended that the waste brick tiles powder can be used as an admixture in concrete production of (10%, and 15%,) by weight of cement.

Key Words: Waste Brick Tiles, Admixture, Pulverization, Powder form, Concrete Strength

1. Introduction

Construction waste is mostly generated during construction, i.e. from the commencement of the concept through design and operational phases of any facility built by engineering construction [1]. Other industries are therefore subject to the influence of constructional activities as the raw materials involved account for the largest input and 50-60% of the total cost of the project [2].

Since waste is a growing problem in many countries as it approximately contributes 20-30% of the total volume of land-fill, waste management seeks to effectively reduce waste sent to the landfills by 43%, thereby reducing energy consumption and material consumption by 40% simultaneously while saving at least 50% of the charges generated for the purpose of waste handling. Scarcity of good natural resources in many municipal areas is rising greatly and demand for concern. Improving material resource maintenance and preservation will meaningfully influence the sustainability of the building industry. Furthermore, the cost of transportation of construction materials has drastically increased which has greatly affected the cost of construction. Hence, an urgent need to incorporate waste management practices in the construction site is very important. [3].

Nigeria assuitable example experiences annually, an increase in over-consumption of materials during construction, a lot of which is improperly utilized, this fact coupled with the speed of urban development by modern methods of construction will generally lead to the renovation of old civil engineering structures not meeting the requirements of the modern standards. It can be safe then to predict that a large mass of Clay bricks will be discarded as waste, according to national statistics, these discarded Clay bricks will amount for 50-70% of construction waste over the next few years under the course of the urban re-development scheme. Due to improper management practices with said Clay bricks, new challenges arose from the main mode of disposal which was to transport the clay bricks to suburban regions and the countryside and bury most of the waste underground and open-air piling for the rest which attracted requisition fees for waste handling practices and also contributed to environmental degradation by pollution [4].

According to Imbabi et al [5], when cement is manufactured, a gas follows the process, this gas is identified to be one of the compounds of Carbon (carbon(iv)oxide), this gas accompanied by a few others make up the green-house gas which has pronounced effects on a number of ecosystems atmospherically. New techniques such as partial replacement are made commonplace in order to reduce the amount of cement required for construction in the hopes of curbing the manufacture of cement while discovering new ways to promote a sustainable environment in coming years. Brick tiles can serve as an alternative to this front, not only because of its inherent ability to behave in a cementitious manner as a binder but also because of its widespread availability [6].

Hemraj and Kumavat [7] proposed that brick if used effectively can develop concrete of good quality and satisfactory mechanical characteristics, his results show the hardened concrete exhibited daily improvement for 28 days. It shows that richer mixes involving more of brick tiles provide higher bulk densities and higher values of compressive strength at replacement levels 40% of sand, these findings contribute to the global research towards minimizing the impact of waste using readily available eco-efficient resources. Hasanpour [8]studied the use of brick tiles for replacement at 40%, and

positively concluded on the latent possibility of using brick tiles although he purported a slight reduction in strength in his findings, he managed to successfully establish its suitability in concrete works. In this article, milled waste brick tiles were studied as an admixture in concrete. We performed various levels of milled waste brick tilesas admixture varying from 0 to 20%, followed by some tests to examine concrete properties.

2. Materials and Method

Portland Limestone Cement (PLC) of grade 42.5 was used in producing 150mm x 150mm x 150mm concrete cubes. River sand was used as fine aggregate and crushed stone as coarse aggregates of nominal size 14mm were used in this work. Potable mixing water was used throughout this study. The waste brick tilesused for this study was sourced from a construction site along Opolo-Elebele Road, Yenagoa, Bayelsa State, Nigeria.

a) Method

The sourced waste bricks tiles were crushed and ground to powder formand were used as an admixture in making concrete cubes of 150mm x 150mm x 150mm at different percentage levels (5%, 10%, 15%, and 20%) by weight of cement.

(a) (b)

Figure 1.0: (a) Waste Brick Tiles (b) Ground Waste Brick Tiles Powder

b) Mix proportion

A mix ratio of 1:2:4 (cement: fines: coarse aggregate) with a water/cement ratio of 0.5 by weight was adopted for this study. A mould of 150mm x150mmx150mm was used for making of concrete cubes.

c) Compressive Strength Test

Sixty cubes of 150 mm × 150 mm × 150 mm were produced for this study, twelve were control (0%) and twelve cubes for each percentage addition (5%, 10%,15%, and 20%) of ground waste brick tiles powder. Cube samples were cured for7, 14, 21 and 28 days. The compressive strength of the specimen was computed by dividing the maximum failure load attained during the test by the cross-sectional area of the specimen. The cubes were tested 7, 14, 21 and 28 days.

3. Results and Discussion

The results obtained in this investigation of compressive strength of concrete at different percentage addition of ground waste brick tiles powder presented in Table 1.0. The results confirmed that the compressive strength of concrete increases with waste brick tiles powder.

From Figure 1.0 – 4.0 given above, with the addition of waste brick tiles powder 5-20% gave noticeably greater concrete compressive strength than 0% concrete strength at 28 days age except 5% addition. At 21 days, concrete cubes with 10 - 15% waste brick tiles powder addition gave average compressive strengths than the control strength. 5% waste brick tiles powder addition reduces the strength at 21days, while 5-15% waste Brick Tiles powder addition increases the strength at 7 and 14 days.

Table 1.0. Compressive Strength of concrete at 7, 14, 21 and 28 days

% Addition	7 Days (N/mm^2)	14 Days (N/mm^2)	21 Days (N/mm^2)	28 Days (N/mm^2)
0%	16.1	19.4	20.2	20.3
5%	17.2	20.2	19.6	19.4
10%	21.6	21.6	22.6	23.6
15%	19.1	19.8	21.3	22.8
20%	16.6	18.0	20.0	22.0

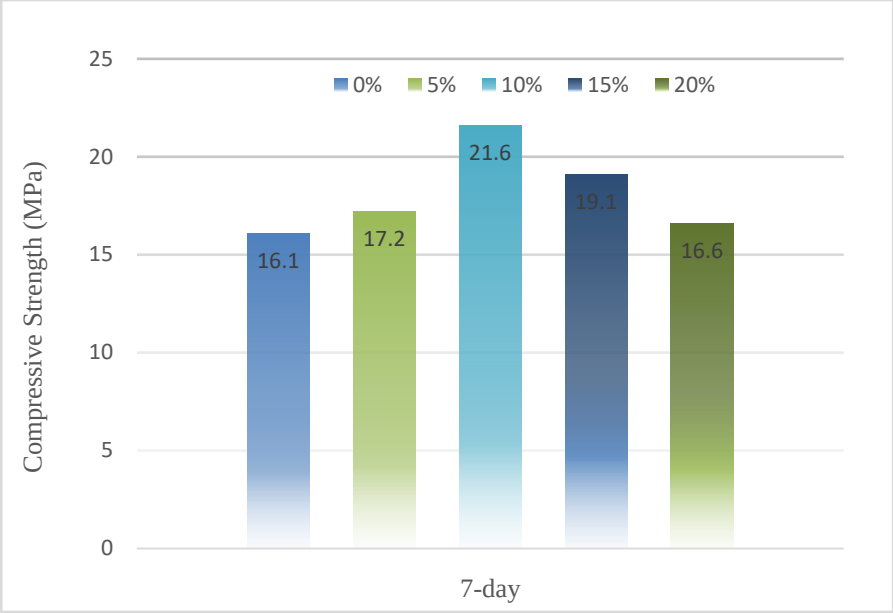

Fig.1 7-day Compressive strength of concrete at different percentage levels (5%, 10%, 15%, and 20%) by weight of cement.

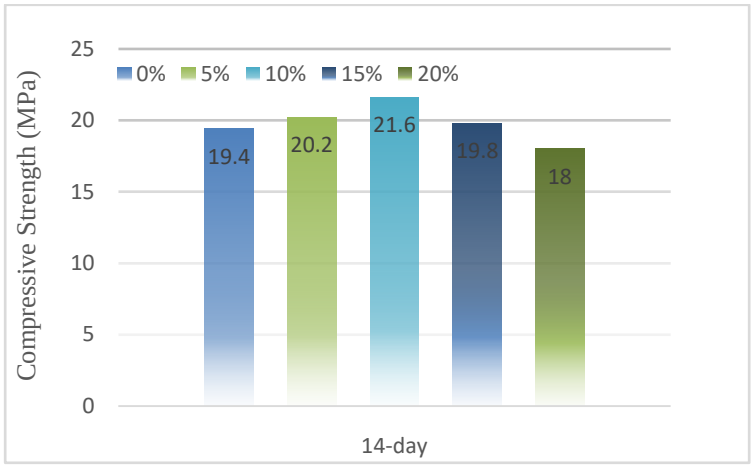

Fig. 2 14-day Compressive strength of concrete at different percentage levels (5%, 10%, 15%, and 20%) by weight of cement

Waste Management

Since waste is a growing problem in many countries as it approximately contributes 20-30% of the total volume of landfill, waste management seeks to effectively reduce waste sent to the landfills by 43%, thereby reducing energy consumption and material consumption by 40% simultaneously while saving at least 50% of the charges generated for the purpose waste handling.Reusing construction waste willreducecharges generated for the purpose of waste handling. Using waste tilesas an admixture in concreteincreases the performance of the concrete.

Natural Resources

Scarcity of good natural resources in many municipal areas is rising greatly and demand for concern. Improving material resource maintenance and preservation will meaningfully influence the sustainability of the building industry. Furthermore, the cost of transportation of construction materials has drastically increased which has greatly affected the cost of construction. Recycling of construction waste will save a lot of natural reserves and also proffers significant environmental benefits

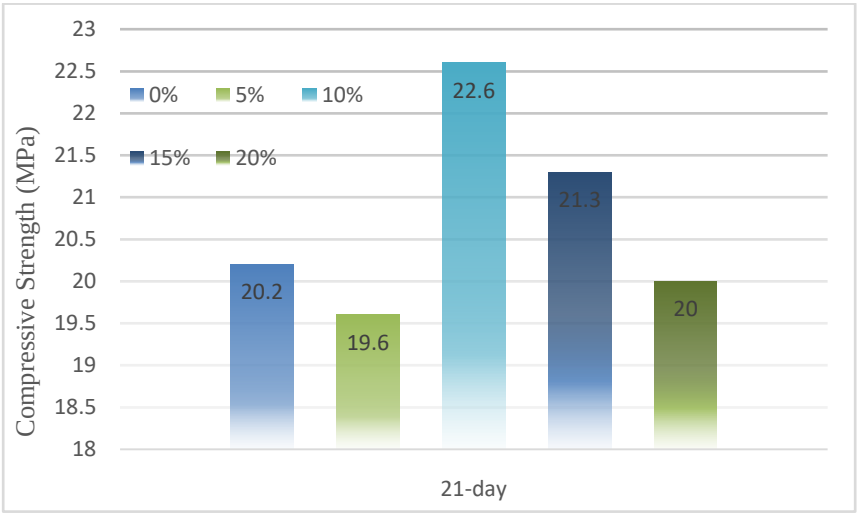

Fig. 3 21-day Compressive strength of concrete at different percentage levels (5%, 10%, 15%, and 20%) by weight of cement

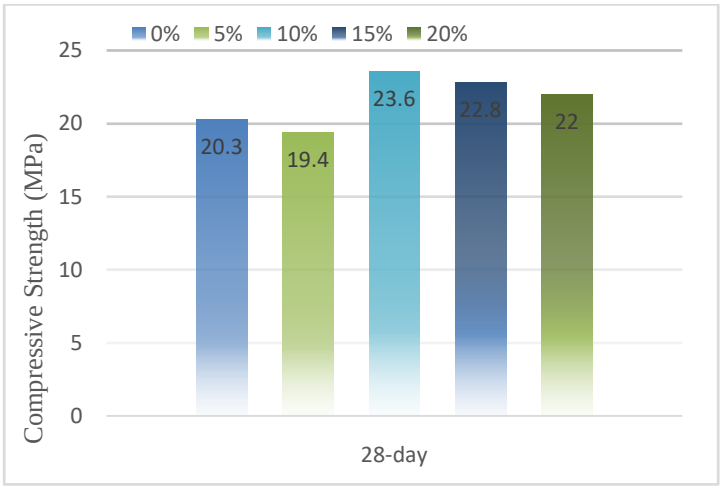

Fig. 4 28-day Compressive strength of concrete at different percentage levels (5%, 10%, 15%, and 20%) by weight of cement

4. Conclusion

The experimental study had been carried out to investigate the effectiveness of ground waste brick tiles as an admixture in concrete production. From results obtained, the following conclusions were drawn.

i. waste brick tiles powder can be used effectively as an admixture in concrete production.
ii. 10% addition of waste brick tiles powder gave about 14% increase in concrete strength at 28days.
iii. 15% addition of waste brick tiles powder gave about 11% increase in concrete strength at 28days.
iv. The best addition dosage of waste brick tiles powder is 10% followed by 15% at 28days.

5. Recommendation

The following recommendations are drawn:

i. Waste brick tiles powder can be used as an admixture in concrete production of (10%,15%, and 20%) by weight of cement
ii. Other construction wastes of higher pozzolans could be used to enhance the used of waste brick tiles powder as an admixture.

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