

Potential Of Fired Clay Bricks Produced From Aponmu Clay Deposits

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Abstract

The potential of fired clay obtained from Aponmu river, Ondo State, Nigeria for brick production have been investigated. Properties of produced bricks investigated was compressive strength, density and water absorption. The results shows that the Compressive strength, density and water absorption values ranged from 2.48 to 3.69 N/mm², 1340kg/m³ to 1650 kg/m³ and 9.87 to 11.46% respectively for the produced bricks. The bricks met the required standard and its recommended for building Bungalow and non-load bearing internal walls.

Keywords: Bricks, clay, compressive strength, water absorption

1 Introduction:

Bricks are classified as being among the most durable of building materials. Buildings made from brickwork have survived hundreds of years and building built of bricks by the Romans are still in first class condition till today [3]. In Nigeria fired clay bricks are fast becoming a good alternative walling material to sandcrete blocks. Its advantages over sandcrete blocks stem from its strength and economic value [11]. In addition to building they are used as drain walling materials, modification of sub grade in the construction of parking lots and pavements around buildings especially in water log areas. The long service life of brick work is a key component of sustainable structure and pavement [10]. The main material used in fired clay brick production is clay obtained from clay deposits, which when mixed with small amount of water becomes plastic.

The origin of clay can be divided into primary sources and secondary sources, with the primary sources comprising the hydrothermal clay deposits, which are mainly by-product of weathering of sedimentary rocks land under in streams, river Lakes and seas and volcanic deposits. A secondary clay deposits which is peculiar to tropical climate is mainly obtained from weathering of pre-existing rocks under exothermic conditions. They are subdivided into residual clay and sedimentary clay deposits [10].

Manasseh [2], investigated the potential of fired clay bricks from Buruku, Makurdi and Naka clay deposits. He observed that bricks made from Naka clay are suitable for use as load bearing walling materials, while Makurdi and Bukuru fired clay bricks are only suitable for use in Bungalow and partitioning walls.

Nigeria is endowed with abundant natural resources which remain unexplored and undeveloped of which clay is one. These available clay deposit are have not been fully utilized. The aim of the study is to evaluate the properties of fired clay bricks produced with clay deposit obtained from Aponmu River, Ondo State, Nigeria and determine its potential. This it is hoped will be of immense economic benefit to the nation and create employment for teeming population.

MATERIALS AND METHOD

Materials

Two types of clay used in this work was Surface clay and Shale clay. They were obtained from Aponmu river, Ilara Mokin., Ifedore Local Government, Ondo State, Nigeria.

Method

The appropriate weight of the shale clay and surface clay was measured and put different plastic container. The measuring beaker was used to measure the volume of water to be used. Then the weighted surface clay, shale clay and water was mixed and blended together using the various composition as shown in table 1 to form an homogenous mixture. The mixed clay was now poured into the prepared mould with internal dimension of 132mm x130mmx100mm and thoroughly rammed with mallet. The bricks was removed from the collapsible mould and left in the open for about 24 hours to dry.

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Thereafter the produced bricks of average size of 132mm x130mmx100mm were loaded into the kiln cars that passed through various temperature zone as they travel through the tunnel. The bricks was fired for about 17 hours . The heat condition in each zone of kiln was carefully controlled and operated. Firing was carried in stages : dehydration from about 149⁰C to 982⁰C, oxidation from 538⁰C to 982⁰C, vitrification from 871⁰C to 1316⁰C, Flashing up to about 204⁰C. The bricks were then allowed to then cool. Fig. 1 shows one of the produced Brick while the composition of the various bricks formulated and produced is shown in table 1.



Fig. 1: Produced Brick

Table .1 : Detail composition of produced brick.

Brick sample	Surface clay (Kg)	Shale Kg	Water (ml)
A	1.65	1.25	900
B	1.45	1.25	900
C	1.20	1.25	900
D	1.10	1.25	900

Density

The density of the brick is mass per unit volume. The brick density test was done by measuring length, breath and height from which the volume was determined. While the mass was done by weighing the brick using weighing scale.

$$\text{Density (kg/m}^3\text{)} = \frac{\text{Mass of the brick (kg)}}{\text{Volume of brick (m}^3\text{)}} \dots\dots\dots (1)$$

Strength test

The test was done by means of universal testing machine by placing the fired clay brick between its two plates. The load was applied gradually until failure occurred .The maximum load at which each brick failed was recorded and used in the computation of the compressive and green strength which was the failure load divided by brick cross sectional area.

Water Absorption Test

Each produced bricks were weight and their dry weights recorded before they were completely immersed in water for 24 hours. The bricks were then removed from water, surface dried in air and weighted. The difference between the dry weights divided by the dry weight of brick ,multiplied by 100% gave percentage water absorption.

$$= \frac{W_1 - W_2}{W_2} \times \frac{100}{1} \dots\dots\dots (4)$$

W₁ =dry Weight , W₂ = wet Weight

RESULTS AND DISCUSSION

Results

Results of Aponmu clay bricks properties obtained are shown in Table 2 while Figure 2 -5, shows the effect of surface clay weight on brick density, green strength , compressive strength and water absorption respectively. Table 3 also show reported properties of bricks produced from some clay deposits in Nigeria [2, 4, 5, 6, 8] .

Table 2:Properties of produced bricks sample and weight of the surface clay

Brick sample	A	B	C	D
Weight of the surface clay(kg)	1.65	1.45	1.20	1.10
Density (kg/m ³)	1650	1540	1390	1340
Compressive Strength (N/mm ²)	2.48	2.55	2.62	3.69
Green strength (N/mm ²)	0.39	0.44	0.5	0.54
water absorption (%)	11.46	11.18	10.87	9.87

Clay	Compressive Strength(N/mm ²)	Water Absorption(%)	Density(kg/m ³)
NIS Standard	>1.5	<25	-
Aponmu	3.69	9.87	1650
Ado	5.0	-	-
Igbemo	9.0	-	-
Bukuru	1.13	18	1640
Markudi	1.32	20	1627
Naka	4.10	20	1410
Jos	-	23.74	2650
Kankara	-	23.65	2600
Oshiele	-	13.65	2600
Shuwari	7.75	14.02	1880
Pulka	9.45	15.87	1610
Ijetu	14.21	15.70	1740
Ubulu-Uku	12.21	17	1760
Ngala	-	-	1750
Eruemukohwarien	7.70	16.77	1780
Ngwo	12.30	40.2	1750
Nsu	11	16.2	1950
Aka	12.5	20	1850

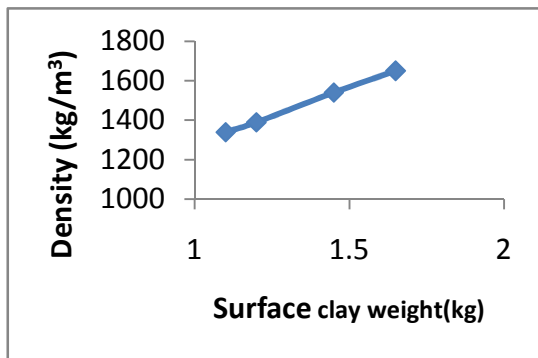


Fig.2: Effect of surface clay on bricks density

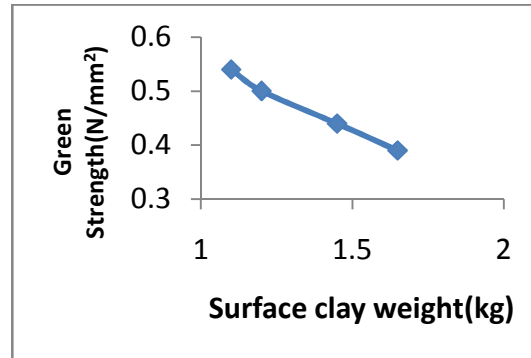


fig.3: Effect of surface clay on the bricks green strength

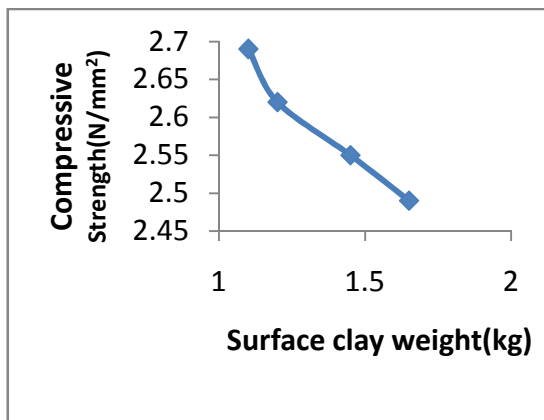


Fig.4: Effect of surface clay on the brick compressive strength

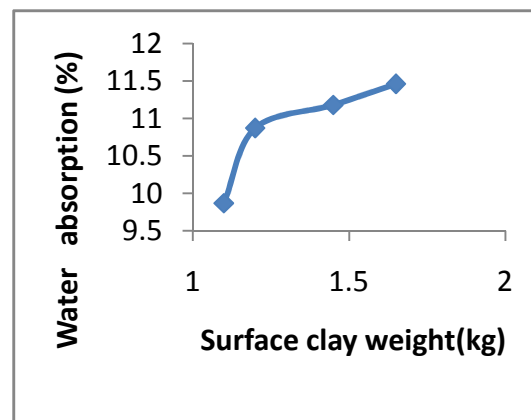


Fig. 5: Effect of surface clay on the bricks water Absorption

Effect of surface clay on the properties of brick

Figure 2 -5, shows the effect of surface clay weight on brick density, green strength, compressive strength and water absorption respectively. It was observed that as the weight of surface clay decreased the density, green strength, compressive strength and water absorption improved. For example when the surface clay weight was 1.20kg the density, green strength, compressive strength and water absorption was 1390kg/m³, 2.62 N/mm², 0.5 N/mm² and 10.87% respectively but when the surface clay increased to 1.65kg the values were 1650 kg/m³, 2.48 N/mm², 0.39 N/mm² and 11.46% respectively. Brick sample D produced with surface clay weight of 1.1kg had the best properties of all produced bricks with its density, compressive strength and water absorption values as 1320kg/m³, 3.69N/mm² and 9.87% respectively (Table 2).

Comparing produced Aponmu clay brick properties with Standard and other Nigeria clay

The density of the produced bricks from ranged from 1340kg/m³ to 1650 kg/m³ (Fig. 2, Table 1). This compares favourably with the densities for bricks from Bukuru (1640 kg/m³), Markurdi (1627 kg/m³) and Naku (1410 kg/m³) respectively reported by [2].

The Compressive strength values ranged from 2.48 to 3.69 N/mm² was obtained for produced bricks (Fig.4, Table 1). These values are higher than values of 1.13 N/mm² and 1.32 N/mm² for bricks made from Buruku and Makurdi respectively reported by [2] but lower than values of 4.0 N/mm² reported by [2] for Naku clay deposits; 9.0 N/mm² and 5.0 N/mm² reported by [9] for sundried bricks produced from Igbemo and Ado clay deposits respectively. Everett (1985) strength criterion of 1.38 N/mm² for non-load bearing walls and [4] strength requirements of 2.75N/mm² for fired clay intended for use in storey building and a minimum value of 1.5 N/mm² for non-load bearing internal walls, were satisfied by bricks made from this clay.

The water absorption values for produced bricks ranged from 9.87 to 11.46% (Fig.5, Table 1). NIS (1976) specified an individual water absorption values of less than 25% for each fired clay bricks, while Everett (1985) specified a water absorption range of 3 to 30% per bricks. The produced bricks satisfied both requirements.

Table 3 shows properties of reported bricks produced from some clay deposits in Nigeria [2, 4, 5, 6, 8].

It was observed that with exception of bricks produced from Buruku, Makurdi and Ngwo clay, the other bricks produced with clay deposit in Nigeria met the NIS standard, 1976 of minimum value of 1.5 N/mm² compressive strength for non-load bearing walls and water absorption value of a maximum value of 25% as reported by [2, 4, 5, 6, 8].

(Table 3). They are therefore recommended for wall partitioning and bungalow use as reported by [7].

CONCLUSION

Clay obtained from Aponmu, Ondo State, Nigeria have been found to have compressive strength, water absorption value and density of 3.69N/mm², 9.85% and 1650kg/m³ respectively. This makes it suitable for the production of brick can be used for wall partitioning and Bungalow. The Aponmu clay bricks properties was found to compare favourably with bricks properties reported for other clay deposits in Nigeria except for Buruku and Makurdi which did not meet the required standard. It is hoped that this work will be of immense economic benefit to the nation and help create employment for individuals.

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