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Influence of water repellent chemical additive and different curing regimes on dimensional stability and strength of earth bricks from termite mound-clay

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Abstract

This article is focussed on evaluating the effects of water repellent admixture and different curing regimes on characteristics of clay from termite hills used for production of earth bricks. Water absorption, thickness swelling and compressive strength characteristics of the specimens with different compositions of cement, hydrated lime and water repellent additive subjected to different curing regimes were measured. The samples were characterised by SEM and FTIR. The least water absorption was at 3.3% while thickness swelling ranged from 0.78 to 3.21 % for the samples. Saturated curing condition resulted in an average compressive strength of 35.5 N/mm², cured curing recorded an average value of 32.9 N/mm² while dry curing condition produced an average compressive strength of 26.9 N/mm² and the wet curing condition resulted in 25 N/mm². SEM characterisation of sample containing 70% termite soil, 30% cement and 0.05 Hydropruf indicated fewer voids, regular and smooth appearance in comparison with others. FTIR analysis showed distinctive broad bands at wave numbers of 3439 cm⁻¹

for O-H stretching, and 1033.83–1008.80 cm^{-1} for O–H bending for all samples tested. The best performing composition in terms of the dimensional stability test was 70% termite mound clay, 10% cement, 20% hydrated lime and 0.05 Hydropruf additive. The highest mechanical strength was from composition of 70% termite mound clay, 30% cement, no hydrated lime and 0.05 Hydropruf additive. It is concluded that saturated and cured method showed better performance than the wet and dry curing regimes. The termite secretions similarly improved the clay composition in conjunction with cement, lime and chemical admixture in the internal structure of the bricks.

Keywords: Materials science, Civil engineering

1. Introduction

Reducing energy consumption of structures is the best pragmatic way of reducing greenhouse gas emissions. Construction industries account for over 40% of global energy consumption [1]. Therefore in order to reduce this energy consumption, the use of viable and environment friendly materials for the building sector will reduce the impact of various structures on the environment. Earth has been tested over many generations and has been accepted universally because it provided many sustainable and financial values that allow it to be an essential choice as a material for the construction sector [2]. Clay soil is a type of soil consisting majorly of closely packed grains and combines one or more clay minerals with interconnected properties; it is usually mouldable when wet [3]. A lot of interest has been shown in its use and therefore studies had been done on the use of fired or unfired clay bricks in both developed and developing countries. Oti et al [4] formulated unfired clay bricks from powdered blast furnace slag using a caustic chemical and concluded that the physical tests and compressive test were within acceptable standards, Miqueleiz et al [5] studied the use of alumina filler material and coal ash waste for the production of unfired clay bricks with results showing that the blended admixture with lime improved the strength of the bricks, El-Mahllawy and Kandeel [6] investigated the properties of modified unfired montmorillonitic clay bricks by subjecting it to various curing systems and reported that the results were improved through wet curing. Fired clay bricks have also been investigated by some authors, among who are Sutcu et al [7], Mounir et al [8], Ngon et al [9] and Velasco [10]. Termite clay is obtained from anthills, while termite mound is a heap of soil made by ants similar to a small hill. Termites usually target unprotected wooden structures and may remain hidden for a very long term because of underground tunnels until massive destruction had been accomplished on the wooden structures. Sometimes, they go beyond destroying wood, they may also spoil textiles, cellulose papers among other items. Some studies had reported that termite clay is a better material than the ordinary clay because it is made of clay whose

plasticity and water resistance property have further been improved upon by the secretion from the termite therefore its utilization for moulding earth brick is encouraged [11,12]. This type of clay has been reported to possess excellent engineering properties more than ordinary clay in dam construction [13]. The clay from the termite hill is able to sustain a permanent structure after moulding because of its resilience; it has fewer tendency of cracking in comparison with conventional clay. Beside these advantages, it is a poor conductor with less solar radiation flow and temperature variation in an enclosed environment when compared with conventional clay [11]. Termite mounds are a common occurrence in most part of the world but are unwanted on lands, most especially in the vicinity of structures. The activities of termites around wooden structures are undesirable; as a result, termite mounds in close proximity to these structures must be broken down and properly disposed of in order to prevent recurrence [14]. This detested material has found very useful applications as a choice material for silo construction because it is cheap and available in the environment [15,16]. It has been utilised for bricks production [17] as well as walling materials [18] and in dam construction [13] among others. Some studies had been concluded on the density of termite mound occurrence in some sub-Saharan Africa countries and results show that huge numbers of termite mound counts were observed within a small sample sized portion of land utilised for the experiments [19,20]. This translates to its relative abundance and availability in sufficient quantities for sustained brick production if utilised. However, most research interests have been focused on improving their strength and the quality of the bricks through stabilization with cement, lime and various agricultural wastes materials; inclusion of natural fibres and burning (fired) [2,21,22]. The major inherent problem reported by most of these studies is the problem of moisture ingress into such structures due to varying environmental conditions in the tropics where they are predominantly used. Not much has been reported on the improvement of the termite clay material either to eliminate this challenge or mitigate its effect. In order to obtain an environment friendly material, it is important to develop materials with improved properties so as to be assured of a longer usefulness and to reduce repair costs. One of the major problem rural structures faces is moisture ingress which affects their durability as well as their properties. The prospects of utilising water repellent chemical admixture used in conventional concrete and mortar as an additive in the termite mound clay brick material are therefore studied in this research. Similarly, the roles of the choice of curing media in improving the compressive strength of bricks were also evaluated.

2. Materials and methods

2.1. Raw materials

Portland cement Type 1 with class strength of 32.5 was used and hydrated lime in powder form (Table 1 shows the composition) also which is widely accepted for

Table 1. Hydrated lime chemical composition.

Composition	(%)
Loss of ignition	24.2
CaO	68.7
SO ₃	0.1
CO ₂	4.8
MgO	0.3
Fe ₂ O ₃ + Al ₂ O ₃	0.7

the production of earth bricks [23]. Termite mound clay (TMC) was excavated from a cluster of mounds located within the University environment. Hydropuf WP100 which is silane/siloxane based powdery water repellent admixture was similarly used. It is a high-performance general waterproofing admixture for concrete and plaster.

2.2. Manufacture of bricks

After its extraction, TMC was dried through spreading in open air within the laboratory at a temperature of 27 °C. Milling follows which involves breaking large pieces of TMC using a ball milling machine. After the grinding, sieving was done using a sieve having a diameter of 5–10 mm. Particle size analysis was performed and shown in Table 2. The next step involved measurement of the constituents based on the composition design shown in Table 3. Manual mixing was done in order to homogenize the mixture of TMC, hydrated lime, cement and Hydropruf additive. Water was added to the mixture progressively which is a standard technique of manufacturing earth bricks. The wet composition was poured into a mould of 50 × 50 × 50 mm and manually pressed for compression. The top of each mould

Table 2. Properties of termite mound clay.

Property value	(%)
Passing sieve 0.08 mm	57
Clay content	58
Silt content	23
Sand content	21
Liquid limit	30.5
Plastic limit	25.4
Plasticity index	5.1
Moisture content	3.53
Specific gravity	2.0

Table 3. Earth brick compositions.

Sample codes	Termite soil (% mass)	Cement (% by mass)	Lime (% by mass)	Hydropruf (kg/m ³)
I	100	-	-	0.05
II	70	30	0	0.05
III	70	20	10	0.05
IV	70	10	20	0.05
V	70	0	30	0.05
VI	100	-	-	-
VII	70	30	0	-
VIII	70	20	10	-
IX	70	10	20	-
X	70	0	30	-

was smoothed and levelled with a hand trowel and the outside surfaces cleaned. The moulds and their contents were left in the laboratory. After 7 days in the laboratory at 25 °C, they were demoulded and curing was done based on the adopted curing regime. A total of 3 replicates were produced for each of the 4 curing regimes with 10 different compositions which give a total of 120 samples. The curing regimes used were: dry, wet, cured and saturated:

- *Dry*: Specimens were dried in ambient conditions at 25 °C. Bricks were stacked on a wooden bench within the laboratory with an allowance of 10 mm between each stack. This allowed the specimens to dry naturally for a minimum of 28 days. The moisture content of typical bricks measured by oven drying at 150 °C after 28 days, was found to be in the range of 0.8–1.6%.
- *Wet*: Specimens were submerged in a water tank for only 24 h at 22 °C before testing. The least spacing of 30 mm was maintained among the samples while the water in the tank was kept at an height of 80 mm above the highest sample. The chosen duration allowed bricks to reach equilibrium in water.
- *Cured*: Specimens were placed in a water tank for 24 h 22 °C, in order to simulate the wet conditioned specimens. Later, the samples were taken out from the tank and wrapped with polyethylene plastic which was kept in a moist condition by a sprinkling of water of 22 °C at an interval of 5 hours. The covering was kept in this moist condition for 28 days. After 28 days, the samples were dried in a ventilated oven at 150 °C until successive difference in weight of ± 1 was attained, allowed to cool down and tested.
- *Saturated*: Samples were immersed in a water tank of 22 °C for up to 28 days. The same specifications used for the wet conditioned samples were maintained. Compressive testing was performed after 28 days.

2.3. Water absorption and thickness swelling

The water absorption test was done in accordance with TS EN 771 [24]. 30 samples of 10 mm × 50 mm × 120 mm were produced for these tests comprising of three replicates per composition. After 7 days in the laboratory at 25 °C, they were cured, dried in the oven at 150 °C until constant weight was achieved. Then, the samples were placed in a curing tank for 24 hours at 22 °C until constant weight was noticed. Thereafter, they were removed and excess moisture was removed by wiping them with a dry cloth and the mass of the samples were measured using the electronic weighing balance. The water absorption was calculated as a percentage. The thickness of each sample was measured after the oven drying using a vernier calliper. The test was used to evaluate the influence of water on the dimensional stability of the samples.

2.4. Compressive strength test

Compressive tests were conducted on the 20 samples of earth bricks after 28 days using the Universal Testing Machine according to the curing age specified within the adopted curing regime for this experiment. The test was performed in accordance with BS 5628 standard [25].

2.5. Scanning electron microscope (SEM) and Fourier-transform infrared spectroscopy (FTIR)

ASPEX Personal SEM (PSEM) was used for the micrograph observation of fractured samples of X, Y and Z. The fracture surface of each specimen was sputter-coated with a thin layer of palladium for the conductive purpose. An acceleration voltage of 16 keV was used to observe the fracture surface of the specimens. FTIR spectra were used to determine the functional groups of earth bricks using a Shimadzu FTIR- 8400S spectrophotometer. The spectra for the specimens were recorded by grinding the specimens to powder, mixing the powder with a small amount of potassium bromide powder and compacting the mixture into a disk.

3. Results & discussion

3.1. Water absorption

Generally, water absorption (WA) was higher in compositions without water-repellent chemical additives, samples such as VII, VIII and IX had WA values of 17.75%, 7.79%, and 12.37% respective (Fig. 1). These values were higher than those containing the water-repellent chemical additive. The difference in WA of the composition of termite mound clay and cement with and without Hydropruf WP100 (compositions II and VII) was noticeably higher at an increase of 71.86%

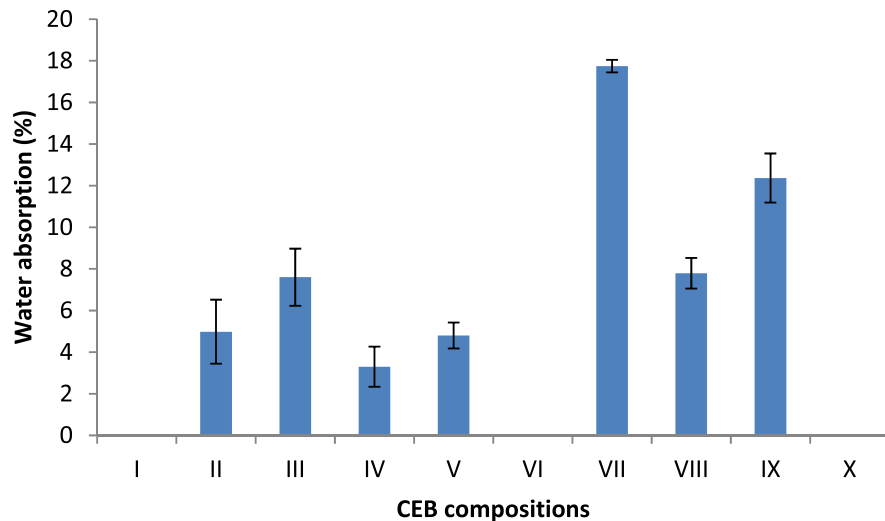


Fig. 1. Water absorption of earth bricks.

for VII. This showed the advantage of the inclusion of water-repellent additive into the composition. Kenneth *et al* [26] similarly observed that the lowest water absorption was observed for earth bricks' which were treated with the water repellent with the highest concentration. Also, WA values of 7.59% and 7.79% were noted for compositions III and VIII which is quite close to each other, this could be as a result of combined stabilisation from cement and hydrated lime in the composition. Only a slight reduction of 2.6% in WA was achieved at III which meant that cement and lime included in VIII reduced moisture absorption in the brick. The highest WA was at composition VII where there was only cement as a binder in the composition; this is due to the absence of lime and Hydropruf WP100. In the same vein, the pores that were left after hydration of cement could have served as an entry point for moisture intake which could have been blocked with the composite action of lime and the additive. A look at compositions where the percentage of lime was higher than that of cement (compositions IV and IX) and with and without Hydropruf WP100 showed that WA was 73% higher in IX. It could be said that hydrated lime is a good void reducer based on these observations. Therefore in compositions where a higher quantity of lime was used more than cement and also coupled with the inclusion of water repellent admixture, these composite reactions produced a sealing effect on the pores which proved to be a strong deterrent for moisture uptake. This condition was satisfied by IV which had the least WA. Muntohar [27] also remarked that lime and rice husk ash stabilized clay earth bricks specimens had lower quantity of absorbed water than the unstabilized ones because they had become impermeable due to the treatment. Compositions I, VI and X with 100% termite mound clay and Hydropruf WP100, 100% termite mound clay and 70% termite mound clay and 30% hydrated lime respectively had no WA values as they all dissolved in water before the 24-hour duration elapsed. Clay cells contain remnant

negative charges on their exterior parts. On immersion in water, the voids between clay granules get taken over by dipolar water molecules. The open cations caused the assimilation of water dipoles to the interlayer and with decreased interlayer space, water uptake in the interlayer space progressed until the interlayer bonds fail which led to the disintegration of samples in water before 24 hours.

3.2. Thickness swelling

Thickness Swelling (TS) test is a dimensional stability test aimed at the determination of the thickness of the samples after it has been immersed in water for 24 hours. Anderson *et al* [28] reported that swelling can take place in clay through two different ways which are crystalline and osmotic swelling. Crystalline swelling could happen in all classes of clay minerals but are short-ranged swelling while osmotic swelling takes place in particular clay minerals possessing transferrable cations in the interlayer region. Compositions I, VI and X had no thickness swelling because they dissolved in water before the 24-hour duration elapsed. This is caused by the interlayer spaces becoming more pronounced due to the absence of cement binder and as the inter-network spaces got bigger, the interlayer bonds failed which led to their final disintegration in water. In addition to this, other factors which could have played their role in this failure include class and valence of the cations, density of the exterior charge, concentration of the electrolytes and the dielectric constant [29]. Compositions II, IV, V and IX had no TS because constant values in thickness after immersion in water for 24 hours were noted. Presence of lime and cement binders in varying proportions with the inclusion of the water repellent chemical, all contributed to this feat. Yool *et al* [30] stated that swelling depends on the clay mineral type. Clay samples having montmorillonite are prone to swelling whereas samples with clay minerals such as pyrophyllite, margarite and illite are classified as non-swelling clays. Similarly, the minerals deposited in the clay by the actions of the termite secretions during the formative phase of the mound helped in this regard also. In the same vein, Kandasami *et al* [31] reported that termites use their secretions and excretions to cause cementation within the mould thereby increasing the strength tenfold. This soil alteration achieved by the termites reduced the mound vulnerability to erosion and failure. This was also corroborated by Lima *et al* [32] who stated that minerals, cation exchange capacity and clay contents were found in the mound soil compared to the surrounding soils. A similar observation was also made by Abe *et al* [33] when they worked on termites mound within the Nigerian Southern Guinea Savanah region. Compositions with TS values are III, VII and VIII with 0.78%, 3.21% and 3.13% respectively. The highest TS was at 3.21% for composition VII which was also observed from the WA results; this could be attributed to the presence of cement at 30% without water repellent admixture. Besides the issue of cement content, possibly low quantities of calcium silicate hydrates (C-S-H) was formed as a product of hydration when termite clay was mixed

with cement, lime and water. The C-S-H helps to bind the particles more closely together thereby reducing the pores in the internal network. The high value of WA could also lead to swelling of the termite mound clay content in the sample which eventually led to the high TS recorded as seen from this study. This was closely followed by composition VIII which also has a high content of cement at 20% without the chemical additive but hydrated lime at 10% was included. This slight difference is majorly due to the presence of lime which has void reducing tendencies. A significant difference could be spotted between the least TS at composition III and the highest TS value at composition VII at 76% increment in its dimensional stability. Combined reactions of cement, lime and admixture produced this positive influence by stabilising the interlayer bonds through the elimination of spaces and voids. The magnitude of clay swelling is usually dictated by type, size and charge of exchangeable cations present in the clay interlayer space as well as layer charge of a clay mineral and the type of additions present [34].

3.3. Compressive strength

The wet cured samples were tested after 24 hours immersion in water but it still performed better than dry conditioned samples as depicted in Fig. 2. This showed the importance of hydration of cement in water which led to a higher compressive strength than air cured bricks. Naderi et al [35] explored the effects of air drying and wet curing methods on compressive strength of concrete; it was stated that lower compressive strength was observed when samples were exposed to air drying within the laboratory for 24 hours compared with the wet cured samples. In terms of individual compositions and curing method performance for earth brick's tested after 28 days, some composition within the saturated group had the best compressive

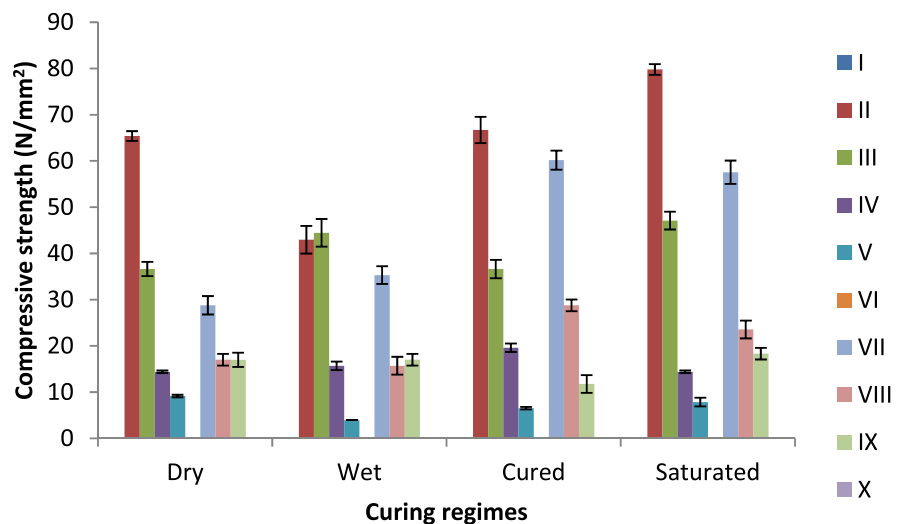


Fig. 2. Compressive strength of earth bricks from termite mound clay.

strength overall. Samples II, VII and III had 79.7 N/mm², 57.5 N/mm² and 47.1 N/mm² in that order. The ANOVA analysis in Table 4 indicates that this saturated method of curing has a statistically significant difference at the 95% confidence level for the majority of the compositions. Similarly, some bricks within the cured group also performed well; these include II, VII and III at 66.7 N/mm², 60.2 N/mm² and 36.6 N/mm². Sample bricks from the dry method of curing had the least performance when compared with the rest methods but some individual compositions within the group still had good results. Cured and saturated curing conditions, however, had higher average compressive strength values in comparison with the dry and wet conditions. Saturated curing condition resulted in an average compressive strength of 35.5 N/mm², cured curing condition produced an average value of 32.9 N/mm² while dry curing condition produced an average compressive strength of 26.9 N/mm² and the wet curing condition resulted in 25 N/mm². These results are still within the accepted standard for Nigeria's earth bricks which stipulates that the compressive strength of earth brick's must not be less than 20 N/mm² [36]. Therefore, the saturated curing condition produced the highest compressive strength in comparison with the other three curing conditions. This was followed by the cured regime, wet and dry in that order respectively.

Table 4 showed the effect of chemical admixture treatment (with and without) and curing methods on similar compositions. II and VII had the same composition proportions but II was treated with the admixture, the ANOVA analysis only showed a statistical significant difference at dry curing conditions while the rest were statistically insignificant. III and VIII also had the same proportions but water repellent additive was included in composition III. Its ANOVA analysis showed that dry, wet and saturated curing conditions had statistically significant differences but cured

Table 4. ANOVA of compressive strength of earth bricks from TMC between similar compositions and the effect of different curing conditions.

Sample composition	Curing	Sum of squares	DF	F statistics	P-value	Result	Conclusion
II and VII	Dry	2247.9600	5	34.0910	0.0043	Reject	Significant
	Wet	1269.1800	5	0.2967	0.6149	Accept	Insignificant
	Cured	351.5198	5	0.8931	0.3982	Accept	Insignificant
	Saturated	915.9480	5	17.0000	0.0146	Reject	Significant
III and VIII	Dry	628.5463	5	44.9847	0.0026	Reject	Significant
	Wet	1344.5000	5	48.3910	0.0022	Reject	Significant
	Cured	389.8835	5	74.4017	0.3278	Accept	Insignificant
	Saturated	893.0554	5	53.9694	0.0018	Reject	Significant
IV and IX	Dry	61.6225	5	0.7976	0.4223	Accept	Insignificant
	Wet	43.6297	5	0.2508	0.6428	Accept	Insignificant
	Cured	153.8993	5	6.0025	0.0704	Accept	Insignificant
	Saturated	43.6297	5	4.4962	0.1013	Accept	Insignificant

Note: DF is a degree of freedom. 95% confidence level was used and the null hypothesis was rejected when the alpha level (0.05) is larger than p-value, therefore a significant difference exists between the groups. The null hypothesis was accepted when the alpha level (0.05) is lower than p-value, therefore an insignificant difference exists between the groups.

had an insignificant difference. In contrast to the others, IV and IX had statistically insignificant differences across the entire curing conditions. The reason for this is that the minimum level of cement needed to improve the strength had been reduced by 10% when they were compared with the other compositions. Presence of cement in sufficient quantity is also needed before the desired compressive strength can be achieved. Clay is said to be prone to exchanging cations so as to maintain inherent electrical charges on its surface. These cations are easily exchanged with organic substances such as water repellent admixtures. This attribute makes application of these chemicals easy for its treatment in order to reduce its moisture intake [37].

3.4. Microstructural analysis

Fig. 3 showed the SEM images of a sample containing 70% termite soil, 30% cement (VII in Table 3) showed poorly interconnected aggregates as well as a porous and inhomogeneous microstructure with voids seen on the surface. This micrograph validates the WA result which showed that the sample had the highest moisture

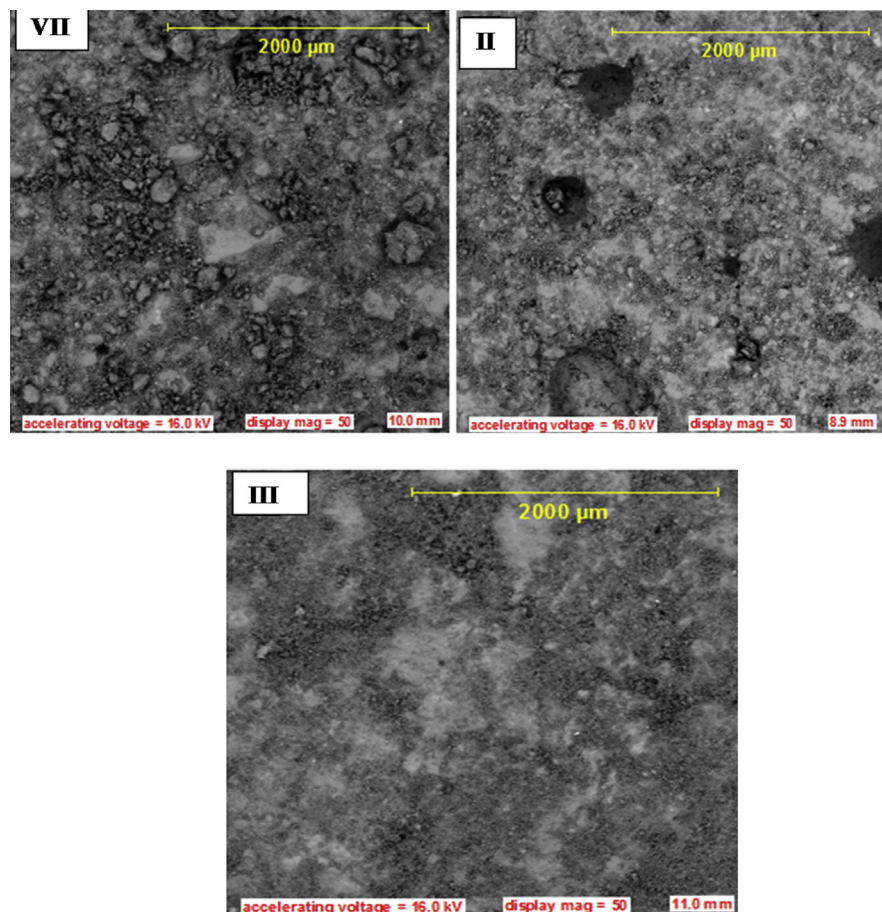


Fig. 3. SEM images of sample bricks II, III and VII.

absorption rate. Similarly, this high porosity observed led to the sample having the highest dimensional instability as seen in Table 3. The voids could have been caused by the residual air bubbles introduced into the bricks during the initial mixing and also it could be related to spaces left by water after cement hydration had been completed [38,39]. Micrograph of sample containing 70% termite soil, 30% cement and 0.05 Hydropruf (II in Fig. 3 and Table 3) indicated fewer voids and a regular and smooth appearance. This development was influenced by the inclusion of the water repellent admixture which caused substantial reduction in voids. TS results showed that no increase in swelling was observed for this sample hence proving the importance of the additive in reducing moisture intake. Similarly, the highest mechanical strength in most of the curing conditions was noted for this sample which is as a result of reduction in voids as observed from the micrograph. The microstructure of sample containing 70% termite soil, 30% cement, 10% lime and 0.05 Hydropruf (III in Fig. 3 and Table 3) affirmed the role of lime as being a good binder and a void reducer substance by reducing voids and microcracks on the as seen on the selected zone. The sample had the least swelling tendency among those that were dimensionally unstable at 0.78%. In the same vein, it was also among the top three performers during the compressive strength testing.

3.5. Fourier transform infrared spectrometer analysis

The FTIR spectra of sample 5 with 70% TM, 30% lime and 0.05 Hydropruf (Fig. 4 and Table 5) showed the high contents in aluminosilicate minerals shown by the Si–O stretching bands between 1000 and 1500 cm^{-1} or 500 – 700 cm^{-1} [40] and the Al–O bending at 400 – 700 cm^{-1} . Distinctive broad bands were observed at the wave numbers of 3439 cm^{-1} for O–H stretching, 1425.44 cm^{-1} for Si–O/Al–O stretching and wave number range of 1033.83 – 1008.80 cm^{-1} for O–H

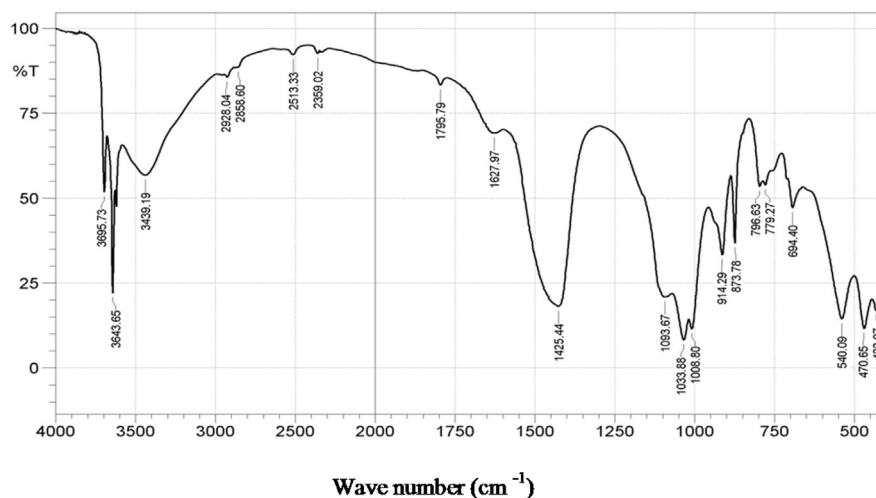


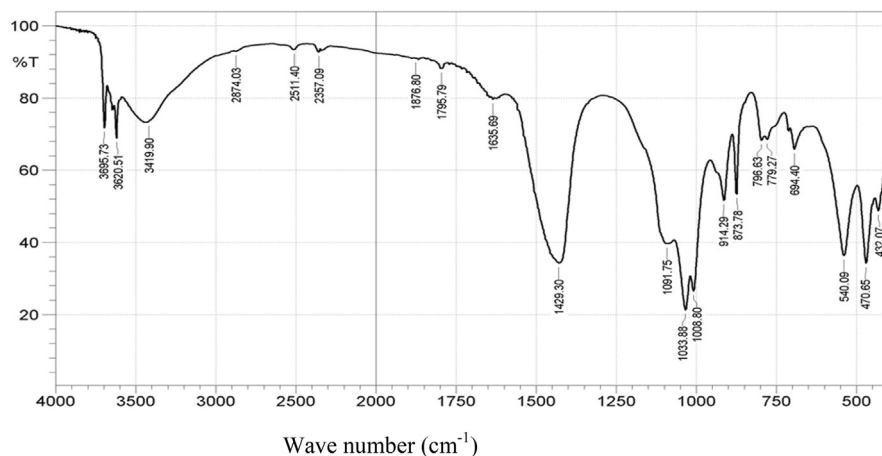
Fig. 4. FTIR of sample 5.

Table 5. FTIR characteristics bands of sample 5.

Vibration frequency	Functional group
3439	-OH- stretching
2928	-C-C- stretching
1627	OH bending
1425	Si-O/Al-O stretching
1033.83–1008.80	Si-O- stretching
914.29	Al-Al-OH
873.78	Al-O
796.63	Al-OH
694.40	Si-O-Al
540.09	Si-O-Al
470.65	Si-O- bending

bending, respectively. A shift of the Si-O band with decrease in intensity is observed from 1425 to 1008.80 respectively. This shift in bands confirms the dissolution of the reactive phases of the aluminosilicate material, which is evident by the substitution of Si-O bonds by Si-O-Al [41,42]. Finally, a decrease in the intensity of the Si-O bending vibration bond is observed from 14.4 to 11.6.

The FTIR spectra of sample 3 with 70% TM, 20% cement, 10% lime and 0.05 Hydropruf (Fig. 5) showed high vibration bands that are characterised with increased intensities. FTIR spectra bands of calcite are located on 2874.03, 1429.30 and 873.78 cm^{-1} [43,44]. The intensity of these bands increased with the introduction of lime to the cement quantity in the brick. In high frequency, a broad band around 3419 cm^{-1} was noticed which is a common trait related to asymmetric stretching vibration bands of hydration water and calcium silicate hydrate (CSH) [45]. The major

**Fig. 5.** FTIR of sample 3.

peaks are observed in the increase of the vibration bands at 3419.90, 1429.30, 1033.88, 914.29, 540.09 and 470.65 cm^{-1} , which is characteristic of the OH vibration of portlandite for the first band [42].

It is apparent from Figs. 6 and 7 which showed the FTIR spectras of sample 8 with 70% TM, 20% cement and 10% lime and sample 9 with 70% TM, 10% cement and 20% lime that the removal of Hydropruf chemical admixture led to a higher vibration band intensity in sample 8 than sample 9. There was an increase in the significant broad bands from 3419.90 to 3439.19 cm^{-1} assigned to OH stretching, 1635.69–1639.55 cm^{-1} assigned to OH bending and 1417.73–1425.44 cm^{-1} assigned to Si-O/Al-O stretching. Also similar vibration bands were observed for both samples at 1033.83, 1008.80, 540.09, 470.65 and 432.07 cm^{-1} depicting that there is not much difference in the chemical reactions due to the slight changes made to both cement and lime in the bricks.

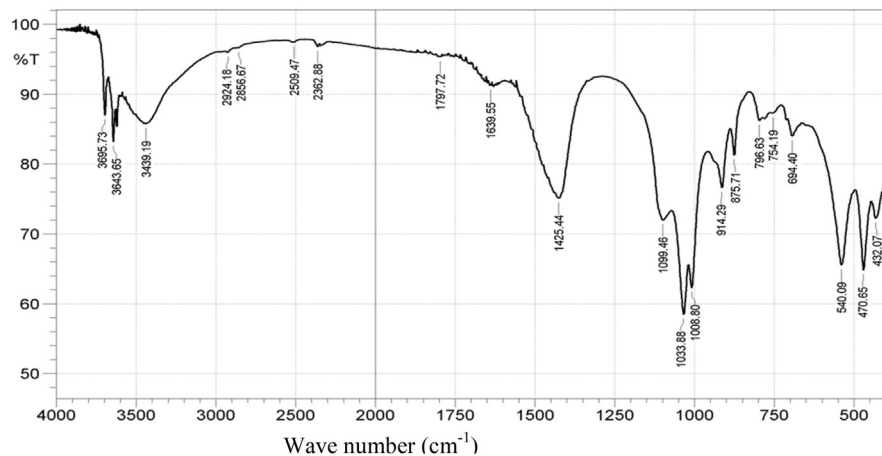


Fig. 6. FTIR of sample 8.

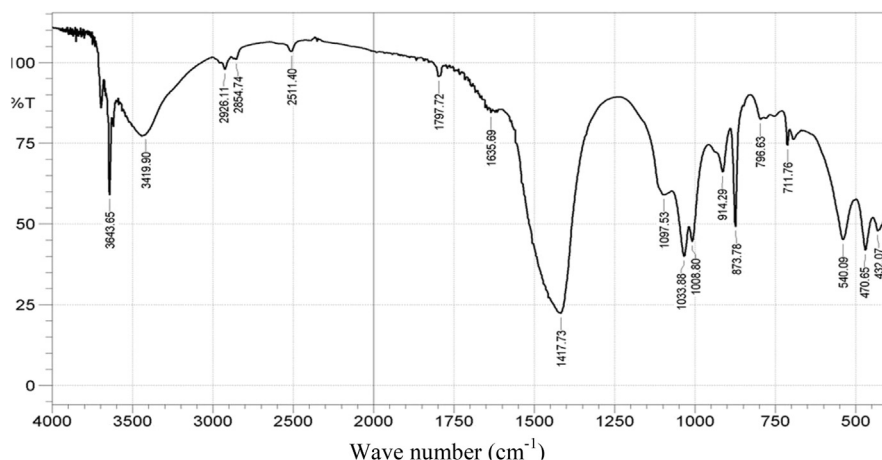


Fig. 7. FTIR of sample 9.

4. Conclusion

The goal of this study was to determine the influence of different curing regimes and water repellent chemical additive on compressive strength and dimensional stability of earth bricks from termite mound clay. The dimensional stability tests, mechanical, microstructural and elemental characterisations were also performed on the samples. The dimensional stability results showed that the best performing composition was 70% termite mound clay, 10% cement, 20% hydrated lime and 0.05 Hydropruf additive. The highest mechanical strength was from composition of 70% termite mound clay, 30% cement, no hydrated lime and 0.05 Hydropruf additive. The curing conditions with optimum performances are the saturated and cured methods based on this experiment. Therefore it is suggested that the use of water repellent additive and saturated curing method be adopted in developing nations where the use of termite mound clay as a building material is predominant.

Declarations

Author contribution statement

Akinyemi Banjo: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Adeola Bamidele: Contributed reagents, materials, analysis tools or data.

Adeoye Oluwanifemi: Performed the experiments.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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