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Durability of Stabilized Earth Brick Modified with Sawdust Ash and Terrasoil Nano Chemical

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ABSTRACT

The study assessed the durability of stabilized earth brick modified with Sawdust Ash (SDA) and Terrasoil Nano chemicals (TNC). The study determined the geotechnical properties and the chemical compositions of laterite. Physical properties of Saw Dust calcined at 600°C and resulting to SDA were assessed using standard methods. Modified Laterite brick with varying proportions of SDA to soil (0, 2, 4, 6, 8, and 10)% and TNC to soil (0, 2 and 5)% were used to make cube specimen of 150×150×150mm. The Compressive Strength (CS), Splitting Tensile Strength (STS), and Water Absorption (WA) of modified bricks specimen were analysed. Two t-tests at 5% significance level were used to determine the effect of SDA and TNC on properties of hardened lateritic bricks. The particle size distribution (PSD) of the laterite samples showed a Coefficient of uniformity (C_u) *of 3.20 and* coefficient of curvature (C_c) *of 1.2 with varying range of the geotechnical properties and chemical compositions depending on the proportion SDA and TNC and amount of laterite. The CS, STS and WA of the modified laterite bricks ranged from 1.12–2.32MPa, 0.22–0.62MPa and 19.5–14.4%, respectively. The best mix of SDA and TNC was 8 and 5%, respectively. Stabilized earth bricks modified with SDA and TNC exhibit improved performance over time. The modified laterite can be used to produce interlocking blocks and kerbs in residential and* commercial buildings.

Keywords: Bricks, Compressive Strength, Laterite, Nano-chemical, Sawdust, Stabilized earth, Terrasoil.

1. Introduction

For a more sustainable future in a built-environment, it is imperative that policy makers, planners, architects, and construction companies understand consumer housing and material preferences (Vasanen, 2012). By 2050, United Nations estimates place global population at approximately 9.6 billion (UN, 2014). Currently, global demand for housing is approximately five million units per year (UN Habitat 2014). As global population increases, an increasing number of housing units will be needed in urban areas. Housing density, as well as green building represents significant factors in sustainable urban development (Dunse *et al*., 2013). Thus, high-rise buildings made of environmentally friendly, renewable materials will play an important role in a more sustainable built-environment. Earth brick is considered as an environmentally friendly choice due to its low carbon emission, low thermal conductivity and good hygroscopic characteristics (Laborel-Préneron *et al.,* 2019). However, some of the disadvantages of earth construction are the lack of strength, durability and vulnerability to erosion by rain (Pelé-Peltier *et al.,* 2022). Unfortunately, due to these drawbacks, the use of earth building materials in the modern construction sector has largely been ignored and is being extensively replaced by more durable and stronger construction materials such as fired brick and concrete (Danja *et al.,* 2017). However, unfired earth masonry provides many advantages compared to traditional fired brick and concrete masonry in terms of environmental impacts. The use of energy-intense processes of conventional fired brick and concrete masonry production leads to high levels of carbon dioxide emissions (Nath *et al.,* 2018). Nanomaterials are a set of substances where at least one dimension is less than approximately 999 nanometers. A nanometer is one millionth of a millimetre approximately 100,000 times smaller than the diameter of a human hair. Nanomaterials have a much greater surface area to volume ratio than their conventional forms, which can lead to greater chemical reactivity and affect their strength. Also at the nanoscale, quantum effects can become much more important in determining the materials properties and characteristics leading to novel optical, electrical and magnetic behaviour (Tingle and Santoni, 2003). Novel discoveries have been made in the use of nanomaterials in the field of environmental geotechnics to improve the strength characteristics of lateritic soils (Onyelowe *et al.,* 2017). Saw Dust Ash (SDA) has been a significant component of Municipal Solid Waste (MSW) in Nigeria. The management of solid waste, including sawdust, has been a major challenge in Nigeria. Industrial waste like sawdust can be harmful to human health if mishandled. Recycling sawdust prevents air, water and soil pollution; saves energy and raw materials; and reduces greenhouse gas emissions (Udokpoh and Nnaji, 2023). Recycling also conserves space in landfill sites. Earth bricks are considered an environmentally friendly choice due to their low carbon emissions, low thermal conductivity, and good hygroscopic properties. They are however deficient in strength, durability and vulnerability to erosion by rain. The study thus assesses the durability of stabilized earth brick modified with Sawdust Ash (SDA) and Terrasoil Nano chemicals (TNC).

2.0 Materials and Method

Materials used include laterite, water, saw dust, and Terrasoil Nano chemicals. Three-laterite soil samples were collected from Igboora (latitude 7^o 25’ 45”) and (longitude 3^o 18 29”) in Igboora local government area, Oyo state, Nigeria covering an area of approximately 250 km^2 to determined their usability for brick production. The sand was graded in accordance with BS 882 (1983). The water used met the specifications of BS 3148 (1980). Sawdust for the study was obtained from a sawmill, calcined using a laboratory muffle furnace at 600°C for 2 hours to remove organic volatiles and alter its properties. The calcined sawdust yielded sawdust ash (SDA) and was sieved and mixed with the laterite in varying proportions. Preliminary analysis of the soil samples in their natural state were done in three replicates as samples 1, 2 and 3 to reveal the geotechnical properties of the laterite, including Particle Size Distribution (PSD) by sieving where soil samples are shaken through a series of sieves with progressively smaller mesh sizes. The amount of soil retained on each sieve is weighed and expressed in percentage and coefficients of uniformity (C_u) and coefficients of curvature (C_c) calculated using equation 1 and 2 respectively (ASTM D6913-04, 2009), Liquid Limit (LL), Plastic Limit (PL), Plasticity Index (PI) were regarded as Atterberg limits determined using methods specified by (ASTM D4318, 2017), Shrinkage Limit (SL) was determined using (ASTM D4943-18, 2018) method, Optimum Moisture Content (OMC) and Dry Density (DD) in accordance with (AASHTO T 99-22 2022) method, Bulk Density (BD) in accordance with (ISO 17892-2 2014) approach.

$$C_u = D_{60} / D_{10} \quad (1)$$

$$C_c = (D_{30})^2 / (D_{60} * D_{10}) \quad (2)$$

Where:
C_u is the coefficients of uniformity
C_c is the coefficients of curvature
D_{60}: Diameter at which 60% of the particles are finer
D_{30}: Diameter at which 30% of the particles are finer
D_{10}: Diameter at which 10% of the particles are finer

Additionally, the chemical composition, such as Iron oxides (Fe_2O_3) was determined Spectrophotometrically using method adopted by (Mohite 2011), Aluminium oxide ($ALOH_3$) and Quartz (SiO_2) were determined by X-ray fluorescence using approach adopted by (Yunzhi *et al.*, 2020), Kaolinite ($Al_2Si_2O_5(OH)_4$) was determined by X – ray diffraction method as outlined by (Irabor and Unuigbe 2023), Organic Carbon (OC) was determined by Walkley-Black method as prescribed by (DSNR) and pH using soil meter SKU: GE779IP6L8XM5NAFAMZ model. Physical properties of the SDA including PSD, BD, OMC, Maximum Dry Density (MDD-SDA) were determined as prescribed above, Porosity was determined by Water Immersion Porosimetry (WIP) technique as prescribed by TGP (2020), and Flowability (FA) were assessed using ASTM D6103 (2017) standard method. Modified Laterite with varying proportions of SDA and Terrasoil Nano chemicals (TNC) at (0, 2, 4, 6, 8, and 10)% and (0, 2 and 5)% soil weight respectively were used to make brick specimen of 240×115×75 mm. Varying the partial replacements of SDA and TNC was to experimentally determine the optimum quantity of each that will produce the best result. The concentration of TNC used was 2.5g/L procured from Zydex Company in Lagos Nigeria. The specimens were cured and crushed at 56 days to obtain the Compressive Strength (CS), Splitting Tensile Strength (STS), and Water Absorption (WA). Though in normal concrete structures, 28-days compression test results are often adopted as it takes 28 days for cement to gain 90 to 99% strength (Abbas 2017) and there is no clear evidence of loss of compression strength of concrete at 56 and 91 days to that of 28 days if all conditions are ideal because as time increases hydration process take place and unhydrated CH are further consumed thus, strength increases (Abbas 2017; Mohammad 2021). Thus, testing up to 56days was selected to examine the behaviour of the bricks at double of the normal testing days. Two t-test at 5% significance level was used to determine the effect of SDA and TNC on properties of hardened lateritic bricks testing the hypothesis to determine if the observed differences in strengths are due to chance or genuine effect. For stabilization, the general dosage of TNC was taken as 1 liter chemical per ton weight of soil (1000ml /1000 kg) in volume to mass ratio (v/m) and regarded as TNC treated soil (1%).

The dosages used ranges from 0ml/1000kg (0%), 2000ml /1000kg (2%) and 5000ml/1000kg (5%). The dilution ratio of Terrasoil Nano chemical to water was 1:100. The dilution was done in line with method outlined by Quansys Biosciences (2023). The TNC treated soil samples were applied at 0, 2 and 5%. The stabilized samples were obtained at varying amount of SDA and TNC treated soil. The behaviour of the stabilized samples was examined for strength and water absorption property. The test on the hardened lateritic bricks are Compressive strength and Split Tensile test using Universal Testing Machine (UTM) at the Central Laboratory, Oyo State College of Agriculture and Technology (OYSCATECH), Igboora. This was compared with that of natural lateritic brick without modifier and bricks standard in accordance with Nigerian Institution of Building code.

3.0 Results and Discussion

3.1. Results of Particle size distribution Tests

Results of sieve analysis on the lateritic soil Figure. 1, reflect a well-distributed particle size, which is essential in determining the gradation and engineering behaviour of soils used in stabilized earth bricks. The percentage cumulative passing shows a gradual reduction from 100% passing at the 4.75 mm sieve size to 2.86% passing at the pan. This distribution signifies that the soil consists of a mix of coarse and fine particles, with a substantial portion falling within the finer gradation. The majority of particles pass through the 0.6 mm sieve, with 76.85% retained, indicating that the soil has a significant fine component that can improve workability and compaction, important for earth brick formation. Furthermore, the coefficients of uniformity (C_u) calculated using equation 1 with values D60 and D10 respectively 0.32 and 0.10 estimated from the curve and on substitution into the equation (1) yielded C_u to be 3.20. This indicates that the soil is well-graded, meaning it contains a good range of particle sizes that will contribute to strong compaction and binding in the stabilized earth brick matrix. A well-graded soil typically provides higher strength and reduced permeability. It has proved to improve the performance of stabilized soil-based materials, (Amadi *et al.*, 2015). The coefficient of curvature (C_c) calculated using equation 2 with value D30 of 0.19 from the curve yielded 1.2 also indicates a well graded soil within the ideal range for optimal engineering performance. The inclusion of sawdust and Terrasoil Nanochemicals, can modify this gradation to improve the mechanical properties of the soil, as demonstrated in similar studies by Obianyo *et al*., (2021).

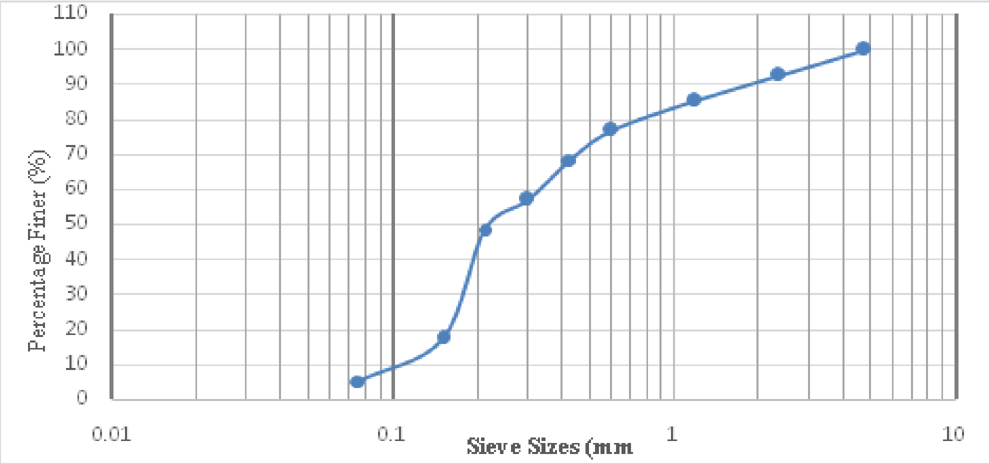

Figure 1: Particle Size Distribution of Lateritic Soil Showing Percentage Finer

3.2 Results of Atterberge Limits Tests

The liquid limit, which measures the moisture content at which soil transitions from a plastic to a liquid state, varies from 28.75 - 31.56% Table 1. These values indicate that the soil samples have a moderate to high plasticity according to Unified Soil Classification System (USCS) specified by (ASTM D2487-17, 2017), reflecting a significant capacity to absorb moisture and exhibit plastic behaviour before solidifying. Wang et *al.,* (2024) observed that higher liquid limits often suggest greater plasticity, which can be beneficial for improving the moldability of stabilized earth bricks but may also lead to issues such as increased shrinkage and potential for cracking if not properly stabilized. Plastic limit defines the moisture content at which soil becomes just plastic enough to be deformed without crumbling. The values are relatively consistent among the samples and varied from 17.89 – 19.23% Table 1. The plasticity index (PI) ranges from 10.86% to 12.33% Table 1, indicating a high range of plasticity across the samples as the USCS outlined that a soil PI above 10 suggest high clay content and plasticity (ASTM D2487-17, 2017). The plasticity index values are crucial as they provide insight into the soil's workability and suitability for brick formation. This aligns with the findings of Kumar *et al.*, (2020), who noted that soils with moderate plasticity from the plasticity index value are generally favourable for brick production as they offer a balance between moldability and stability. The shrinkage limit, which indicates the moisture content below which soil will no longer shrink upon drying, shows values of 7.23%, 6.95%, and 7.45% for the samples as shown in Table 1. These relatively low values suggest that the soil exhibits minimal shrinkage, which is advantageous for preventing cracks in the final brick product. The bulk density values, which measure the mass of soil per unit volume including voids for the sample's replicates were 1.88 g/cm³, 1.82 g/cm³ and 1.85 g/cm³ respectively. These values indicate a relatively high bulk density, reflecting a well-compacted soil with minimal voids. High bulk density is desirable in construction materials as it typically correlates with better stability and load-bearing capacity.

Table 1. Atterberg Limit Test Results for the Laterite Soil Samples

Samples	Liquid Limit LL (%)	Plastic Limit PL (%)	Plasticity Index PI=LL-PL (%)	Shrinkage Limit SL (%)	Shrinkage Index SI= PL-SL (%)
1	31.56	19.23	12.33	7.23	12.28
2	28.75	17.89	10.86	6.95	10.44
3	30.23	19.00	11.23	7.45	11.77

3.3 Results of Chemical Analysis of Laterite

The chemical composition of lateritic soil samples Table 2, reveals key elements that influence the suitability of the soil for stabilized earth brick production. The iron oxide (Fe_2O_3) was highest in sample 1 (13.87%) and lowest in Sample 3 (9.5%). Iron oxides play a significant role in the structural integrity and compressive strength of earth bricks. A higher concentration, such as in Sample 1, enhances the soil's binding properties, contributing to improved durability in stabilized earth bricks. This finding aligns with research by Abdulazeez *et al.,* (2024), which demonstrated that increased iron oxide content improves the strength of lateritic soils used in brick production. In terms of aluminium oxide ($Al(OH)_3$), Sample 3 exhibits the highest concentration at 16.92%, while Sample 1 has the lowest at 11.85%. Aluminium oxide, particularly in the form of gibbsite, is crucial for the soil's plasticity and workability. Higher aluminium oxide content, such as in Sample 3, increases the plasticity of the soil, making it easier to mould and compact during brick production. However, excessive plasticity may lead to shrinkage issues, especially during drying, which could affect the final brick’s stability. This finding agrees with the research by Zhang and Liu (2019), which suggested that soils with moderate aluminium content tend to strike a better balance between plasticity and shrinkage. Furthermore, the kaolinite ($Al_2Si_2O_5(OH)_4$) content is particularly high in Sample 1 and Sample 3, at 37.49% and 37.11%, respectively, compared to Sample 2 with 23.27%. Kaolinte, a clay mineral, is crucial in controlling the soil's plasticity and shrinkage properties. High kaolinite content indicates that these samples will exhibit moderate plasticity and relatively low shrinkage, which are desirable traits for stabilized earth bricks. This finding supports the conclusions of AMI, (2022) that reported that kaolinite-rich lateritic soils exhibit enhanced stability and lower susceptibility to shrinkage cracks in earth bricks.

Table 2: Chemical Composition of Lateritic Soil Samples

Chemical Composition	Sample 1	Sample 2	Sample 3
Iron oxides (Fe_2O_3)	13.87	10.91	9.5
Aluminum oxide ($Al(OH)_3$)	11.85	13.39	16.92
Kaolinite ($Al_2Si_2O_5(OH)_4$)	37.49	23.27	37.11
Quartz (SiO_4)	46.72	49.2	47.65
Organic content	2.58	3.33	2.62
PH	7.63	5.17	6.43

3.4 Physical characteristics of Saw Dust Ash (SDA)

The physical properties of SDA are presented in Table 3. The bulk density of the sawdust ash samples ranges from 0.45 to 0.55 g/cm³, with an average of 0.50 g/cm³. This relatively low bulk density indicates that the sawdust ash is a lightweight material. Finally, the flow ability of the sawdust ash samples ranges from 55.20 g/100g to 65.55 g/100g, with an average of 60.75 g/100g. This measurement reflects how easily the material can flow and be handled. Higher flow ability indicates better handling characteristics, which is important for mixing and processing in construction applications. Research by Patel and Sharma (2018) underscores the importance of flow ability in ensuring efficient processing and uniform mixing of fine materials in construction.

Table 3: Physical Properties of Sawdust Ash

Physical Properties of Sawdust Ash	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm³)	0.45	0.50	0.55	0.50
Moisture Content (%)	10.21	12.50	11.46	11.39
Porosity (%)	70.28	65.12	68.20	67.87
Compaction Characteristics				
Maximum Dry Density (g/cm³)	0.60	0.62	0.58	0.60
Optimum Moisture Content (%)	15.30	14.10	16.30	15.23
Flow ability (g/100g)	61.49	55.20	65.55	60.75

3.5 Compressive Strength Characteristics of SDA and TNC

Figure 2 shows the compressive strength of earth bricks modified with varying compositions of sawdust ash (SDA) and Terrasoil Nanochemicals (TNC) over different curing durations. The control sample, which had no SDA or TNC, showed steady improvement in compressive strength from 1.12 MPa at 7days to 1.48 MPa at 56days. This provides a baseline for evaluating the performance of the modified samples. The gradual increase in strength aligns with the natural hydration process observed in untreated lateritic soils. When 2% SDA was introduced without TNC, the compressive strength improved slightly across the curing periods, reaching 1.68 MPa at 56 days. This indicates that sawdust ash, acting as a stabilizer, has a positive effect on the compressive strength. The addition of 2% TNC to 2% SDA further improved the strength, with values reaching 1.9 MPa at 56days. This suggests that TNC plays a significant role in enhancing the strength properties of the bricks, as Nanochemicals have been noted for improving the durability of construction materials by increasing their density and reducing porosity. At higher compositions of SDA and TNC, a similar pattern emerges. For instance, the combination of 2% SDA and 5% TNC exhibited a compressive strength of 2.05 MPa after 56 days of curing. This is a notable improvement over both the control and the 2% SDA with 2% TNC samples. The presence of TNC appears to have a synergistic effect with SDA, leading to better performance. As more SDA and TNC were added, such as in the case of 4% SDA + 5% TNC, the compressive strength rose further to 2.1 MPa at 56days. This gradual increase in strength highlights the effectiveness of these additives in improving the structural integrity of earth bricks. Notably, the samples with 6% SDA and 5% TNC showed an even higher compressive strength of 2.2 MPa at 56days, the highest among the tested compositions. This emphasizes that a higher proportion of stabilizers contributes significantly to the material's strength, although the trend does not increase indefinitely, as seen with 8% SDA and 5% TNC, where the strength reached 2.32 MPa at 56 days.

The plateauing of compressive strength at higher SDA percentages may suggest an optimal limit for SDA and TNC in achieving the desired balance between strength and workability. In comparison with other studies, similar trends of strength enhancement have been observed in earth blocks stabilized with alternative additives such as cement or lime. For instance, Ndihokubwayo *et al.,* (2019) noted that the use of cement and other stabilizers in compressed earth blocks led to significant improvements in compressive strength over time, akin to the results seen with SDA and TNC in this study. Moreover, the improvements in strength noted here align with findings from previous research that highlighted the positive impact of using nanomaterials to modify soil and clay properties (Amin *et al.*,2020). These studies confirm that Nanochemicals like Terrasoil, when used alongside organic stabilizers such as sawdust ash, can yield high-performance building materials suitable for sustainable construction.

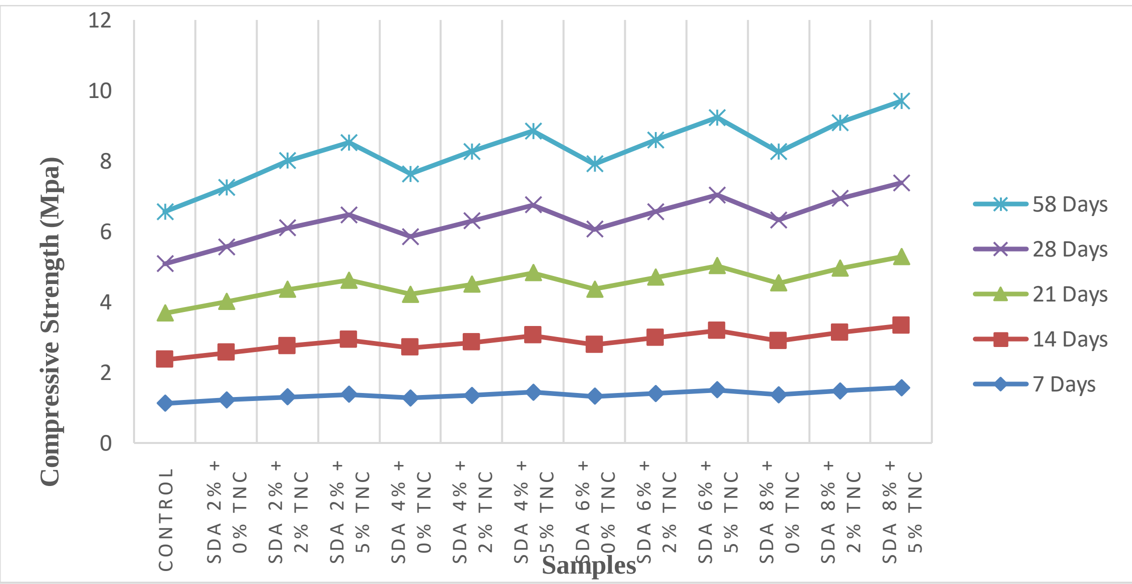

Figure 2: Compressive Strength of Stabilized Earth Bricks

3.6 Results of Splitting Tensile Strength Tests and Water Absorption Tests

Figures 3 and 4 show splitting tensile strength and water absorption test over varying curing durations and different compositions of SDA and TNC. The control sample, which contains neither SDA nor TNC, shows modest improvement from 0.22 MPa at 7 days to 0.39 MPa at 56days. This represents the baseline tensile strength of untreated earth bricks, which is consistent with typical lateritic soil performance under unmodified conditions. When 2% SDA was introduced without TNC, the tensile strength improved slightly, reaching 0.44 MPa at 56days. The increase is indicative of the positive influence of sawdust ash as a stabilizing agent, although the enhancement is marginal compared to samples containing TNC. However, when 2% TNC was combined with 2% SDA, the splitting tensile strength improved further, reaching 0.5 MPa at 56days. This demonstrates the significant role of Nanochemicals in improving tensile strength, as TNC aids in reducing the micro-cracks and enhancing the cohesion between particles in the modified brick. The trend continues as the concentration of SDA and TNC increases.

For instance, at 2% SDA and 5% TNC, the tensile strength reaches 0.54 MPa after 56 days, representing a significant improvement over the control sample. The interaction between sawdust ash and Nanochemicals appears to create a more robust material matrix, allowing for better resistance to tensile stresses. A similar pattern was observed with 4% SDA and 5% TNC, where the tensile strength reaches 0.58 MPa at 56days, further validating the beneficial effect of the dual-stabilization approach. Notably, the combination of 6% SDA and 5% TNC yields a tensile strength of 0.6 MPa after 56days, highlighting the potential of higher SDA and TNC proportions in enhancing tensile properties. However, the results with 8% SDA and 5% TNC indicate that the tensile strength reaches 0.62 MPa at 56days, suggesting a diminishing return on strength improvement as the SDA content increases. This indicates that while higher stabilizer content does improve strength, there may be an optimal limit beyond which its addition is less significant.

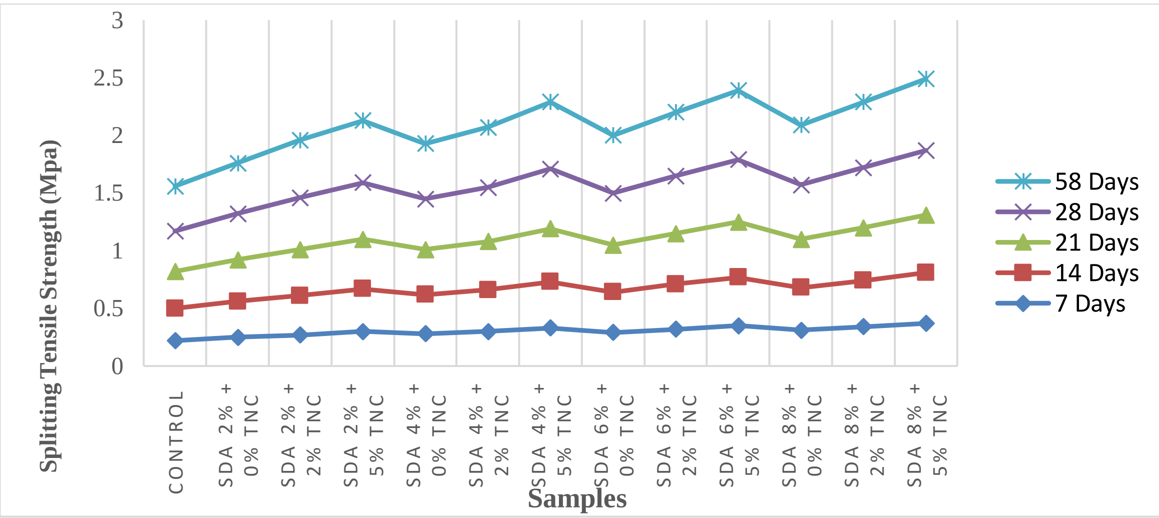

Figure 3: Splitting Tensile Strength of the Stabilized Earth Bricks

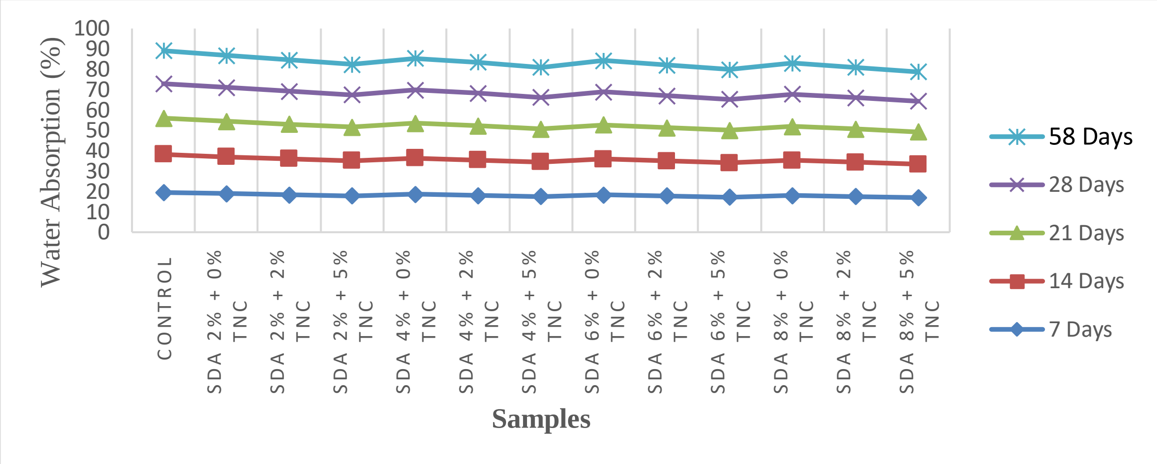

Figure 4: Water Absorption Properties of the Stabilized Earth Bricks

A notable observation is that even with 6% SDA and 5% TNC, the water absorption continues to drop, reaching 14.6% at 56 days. This indicates that the higher proportions of stabilizers result in a consistent improvement in reducing water absorption, reinforcing the conclusion that the combination of organic and Nanochemicals additives enhances the water-resistant properties of the modified earth bricks. When the SDA content is increased to 8%, with 5% TNC, the water absorption reaches a low value of 14.4% at 56 days, suggesting that this combination may represent the optimal mix for achieving the best water absorption performance.

3.7 Comparative analysis SDA and TNC as replacement in concrete

The optimal ratio of strengths and water absorption properties are presented in Table 4. The compressive strengths of the modified lateritic soil bricks with SDA and TNC in all the mix ratios are greater the unmodified (control) samples and ranges from 1.68 to 2.32MPa as against 1.48MPa. This indicates that the SDA and TNC have enormous impact in improving the strength of laterite with the proportion with 8% SDA and 5% TNC having the most strength. Similarly, the splitting tensile strength of the modified laterite soil bricks blended with SDA and TNC in all the mix ratios are greater than the unmodified (control) samples and ranges from 0.44 to 0.62MPa as against 0.39MPa and is highest with the mix containing 8% SDA and 5% TNC. The water absorption is more in the lateritic soil without modification 16.20%, and lowest at 8% SDA and 5% TNC indicating a superior quality when laterite is modified with SDA and TNC at 8% and 5% addition respectively. The t-test shows that the modified bricks treatments and strengths are statistically significant at 5% significance level as there are real differences between the treatments and their corresponding strengths.

Table 4: Optimal Ratio of Compressive Strength and Splitting Tensile Strength across different days.

Samples	Curing Days	Compressive Strength (MPa)	Splitting Tensile Strength (MPa)	Water Absorption (%)
Control	56	1.48	0.39	16.2
SDA 2% + 0% TNC	56	1.68	0.44	15.8
SDA 2% + 2% TNC	56	1.9	0.5	15.4
SDA 2% + 5% TNC	56	2.05	0.54	15.0
SDA 4% + 0% TNC	56	1.78	0.48	15.6
SDA 4% + 2% TNC	56	1.97	0.52	15.3
SDA 4% + 5% TNC	56	2.1	0.58	14.8
SDA 6% + 0% TNC	56	1.85	0.5	15.4
SDA 6% + 2% TNC	56	2.03	0.55	15.0
SDA 6% + 5% TNC	56	2.2	0.6	14.6
SDA 8% + 0% TNC	56	1.94	0.52	15.2
SDA 8% + 2% TNC	56	2.15	0.57	14.9
SDA 8% + 5% TNC	56	2.32	0.62	14.4

4. Conclusions

The results of the particle size distribution tests indicate that the soil has a significant fine component that can improve workability and compaction which are important for earth brick formation. The coefficients of uniformity (C_u) value of 3.20 indicates that the soil is well-graded, meaning it contains a good range of particle sizes that will contribute to strong compaction and binding in the stabilized earth brick matrix. The liquid limit, plastic limit and plasticity index values signifies a good range of plasticity with a very low potential for cracking even if not stabilized though shrinkage limit value indicates minimal shrinkage. The chemical composition of lateritic soil supports its use in stabilized earth bricks, with high iron oxide and quartz content boosting strength. Kaolinite adds desirable plasticity, while low organic content ensures durability. The pH influences stabilizer compatibility. Adding SDA and TNC significantly enhances the compressive and tensile strengths of earth bricks. This underscores their crucial role in boosting the durability and overall performance of modified bricks. Optimal durability, compressive and tensile strengths and water absorption in earth bricks was achieved with higher 8% SDA and 5% TNC percentages in the stabilized earth bricks exhibiting improved performance over time. The modified laterite can be used to produce interlocking blocks and kerbs in residential buildings.

Conflict of Interest

The authors declare that they have no conflict of interest.

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