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# Relationships between fibre dimensional characteristics and shrinkage behavior in a 25 year old *Gmelina arborea* in Oluwa forest reserve, South West Nigeria

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**ABSTRACT**

*This studyexamined the relationships between fibre dimensional characteristics namely fibre length, fibre diameter, lumen and cell wall thickness and shrinkage beharviour of 25- year -old Gmelina arborea. Five trees with clear bole were randomly selected and felled from Oluwa Forest Reserve. Wood samples were systematically sampled at base 10%, middle 50% and top 90% of the merchantable height. Radiallythe wood samples were partitioned into outerwood, middlewood and innerwood. The mean fibre length, fibre diameter, cell wall thickness and lumenobtained for Gmelina arborea were 1.24mm, 21.21µm, 18.31µm and 1.81µm respectively.The mean radial shrinkage, tangential shrinkage and volumetric shrinkage obtained were 4.47%, 6.46% and 11.32%. Fibre dimension decrease from base to top and increased from innerwood to outerwood. Shrinkage characteristics increase from base to top and decrease from outerwood to innerwood.Statistical analysis conducted to testthe significance of the variability in the properties examined were significant at 5% probability level. Effect of anatomical properties was best observed in volumetric shrinkage and was followed by tangential shrinkage with and radial shrinkage*

**Key words:** *Gmelina arborea* wood, Fibre Length, Fibre Diameter, Lumen, Cell Wall Thickness, Radial Shrinkage, Tangential Shrinkage and Volumetric Shrinkage.

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## INTRODUCTION

Fibres are principal element that is responsible for the strength of wood. They are composite material in that they consist of a reinforcement of cellulose microfibrils in a cementing matrix of hemicelluloses and lignin[24]. The rigidity of many woods is due to fibre content and this determines the value of a species for many end uses. Fibres have thicker walls than other cells found in wood and this influence the mechanical properties of wood.[15] asserted that they are strength supporting cells that compose the bulk of the cells of many hardwoods. Fibres also influence the shrinkage and working properties of timber, drying characteristics as well as pulping properties of wood [19, 3].[11] stated that fibre wall thickness, diameter and fibre length increase rapidly with increase distance from pith. The increases in fibre length from pith to bark are due to the increasing age of the tree with a resulting effect on cell wall development[15]. Height in tree has little effect on fibre length, while fibre diameter increase with height in tree to about mid- height followed by a decrease higher up [26, 27]. [22] reported a decreasing trend in wood fibre length from the tree base to the top. This decreasing trend on wood fibre length is attributable to the influence of the growth promotion substances which are close to the growing tip. These growth promoting substances initiate rapid production of cells with decreasing maturation time thereby resulting in the production of short cells at the tree top. [2] stated that fibre wall thickness is closely related to wood density, variation in cell wall thickness from tree to tree within individual trees is similar to patterns of density variation. These anatomical properties according to [13, 15] have a positive correlation on the strength characteristics of wood. [13] reported that the major contributors of the strength of *Celtis adolfi-friderici, Celtis mildbraedii and Celtis zenkeri* includes wall thickness of the vessels and fibres, fractional wall volumes of the vessels and fibres and the length of the fibres. Fibre dimension are determined by the dimensions of the cambial fusiform cells from which they are derived and by the process that occurs during cell differentiation[20, 21].The objectives of this study were to investigate the variations in fibre length, fibre diameter, lumen diameter, cell wall the thickness and relationship between fibre dimension and shrinkage properties of a 25-year old *Gmelina arborea* wood grown in Nigeria.

**Study Area**

Wood samples of *Gmelina arborea* were collected from Oluwa Forest Reserve located in Odigbo Local Government Area, Ondo State. The reserve is located in the humid tropical zone of South-western Nigeria. It is lies between latitude 6º55´ and 7º20´ North and longitude 4º45´ and 5º32´ East.The rain fall pattern is bimodal with distinct wet and dry season characterized by humid conditions in the south and sub-humid conditions in the north. The reserve has a mean annual humidity of about 80%, mean annual temperature of about 26ºC, and mean elevation of 123m above sea level [17], and about 19,000ha forest land in Oluwa forest reserve have been converted to forest plantation, while the remaining area is mostly accounted for by degraded natural forest (927,000) and arable farmland (31,000). [16]. The soils are predominantly ferruginous tropical soils and are typical of the variety found in the intensively weathered areas of basement complex formations in the rainforest zone of Southwest in Nigeria.

## MATERIALS AND METHODS

Five trees were randomly selected fromeven aged stand of *Gmelina arborea* in Oluwa Forest Reserve. This wasdone in accordance with the procedure of ASTM D143-83 standard.Sample trees with very close diameter classes, relatively straight stem and clear wood were selected. Wood samples for the test were systematically collected from the innerwood section (near the pith) and outerwood section (close to the bark) while the middlewood section was collected from midpoint between. The wood samples were converted to three bolts of 50cm long at the base 10%, the middle 50% and top 90% of merchantable height in each of the sample trees resulting in fifteen (15) bolts. The bolts were partitioned into three equal zones namely innerwood, middlewood and outerwood along the radial plane. 12 samples test of dimension 2cm × 2cm × 30cm were obtained from each plank making 36 test samples per tree to give a total of 180 test samples.

Test samples used for fibre dimension evaluation were collected from the radial and longitudinal positions. Wood samples measuring 20mm x 20mm x 30mm were collected and softened by boiling for 24 hours in a beaker of water over a hot plate. Thin sections of 20 microns were prepared from the three well oriented planes vis-à-vis cross sectional, transverse radial longitudinal sections (R.L.S.) and tangential longitudinal sections (T.L.S.) respectively, using a microtone slicing machine according to the procedure used by [31]. The microtoned wood sections were placed into petridishes containing methylated spirit for moistening. Methylated spirit was used in order to prevent rolling and flaking characteristics of wood sections. Staining was immediately done by adding drops of safranin solution to the sections in the petridish and left for ten minutes. The stained wood sections were dehydrated with 95% ethyl alcohol (ethanol) for about 60 seconds and were cleaned using cedar wood oil as a cleaning agent. This facilitated easy lifting of section during mounting.

Dimensions of cells from each representative samples were on the average of 25 measurements. One section each was lifted from the petridish with the aid of a forceps into a slide and trimmed to sizes for coverage with a slide cover of 2 cm square. Filter paper was used to mop up excess oil. Canada balsam was added to the slide and covered with cover slid. The prepared slides were placed over a hot plate to expel air bubbles and also effect even spread of Canada balsam on the slide. The slides were observed under a photomicrograph electronic microscope with tracer reflector and this brought out the different anatomical features of the wood. All the projected fibres were measured for anatomical characteristics evaluation such as fibre length, fibre diameter, fibre lumen width and cell wall thickness.

Test specimens of 2cm x 2cm x 5cm were used for determination of shrinkage. They were soaked in water for 48 hours in order to get them conditioned to moisture above Fibre Saturation Point (FSP). Specimen was removed one after the other; their dimensions in wet condition were taken to the nearest millimeter using 40- 6925 digital vernier caliper. Percentage shrinkages along the two planes were measured after specimens had been oven-dried. Radial, tangential and volumetric shrinkage of the test samples were calculated using the following relationship:

$$\text{RdS} = \frac{D_r - d_r}{D_r} \times 100 \ldots\ldots \quad 1$$

$$\text{TgS} = \frac{D_t - d_t}{D_t} \times 100 \ldots\ldots \quad 2$$

Where:
RdS = radial shrinkage (%)
TgS = tangential shrinkage (%)
$D_r$ = initial dimension along the radial axis at green MC of ≥30%
$D_t$ = initial dimension along the tangential axis at MC of ≥ 30%.
$d_r$= final dimension along the radial axis at oven dry MC of < 30%.
$d_t$ = final dimension along the tangential axis at oven dry MC of <30%

$$\text{VS} = S_R + S_T \ldots\ldots 3$$

Where:
VS = Volumetric Shrinkage
$S_R$= Radial Shrinkage
$S_T$ = Tangential Shrinkage

The data generated were subjected tostatistical analyses using analysis of variance (ANOVA), and multiple regression models. The regression of selected dependent variables ($Y_i$) on some independent variables ($X_i$) used for the data processing is as statedin the equation 4

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4E_{1\ldots\ldots 4} \ldots\ldots \quad 4$$

Where
$Y_i$= Shrinkage characteristics, $b_0$= Constant (intercept on Y- axis), $X_1$= Fibre Length, $X_2$ = Fibre diameter, $X_3$ = Fibre lumen, $X_4$ = Fibre wall thickness, $b_{1\text{-}4}$= Coefficient of $X_{1\text{-}4}$, E = Error of estimation.

## RESULTS AND DISCUSSION

### Fibre length

The mean fibre length obtained for *Gmelina arborea* was 1.24mm. The value ranged from 1.20mm at the top to 1.28mm at the base. While radially the mean ranged from 1.18mm at the innerwood to 1.32mm at the outerwood (Table 1). Specifically, fibre length decrease gradually from base to the top along the vertical axis. Across the bole it increases steadily from innerwood to outerwood (Table 1). The pattern of variation observed in this study had earlier been reported by [31] in the wood of *Eucalyptus globules*, [14]in the wood of *Triplochiton sceleroxylon*,[8] in the wood of *Tectona grandis*. They attributed the increase in fibre length to increase in the length of cambial initial with increasing cambial age. Decrease in fibre length from base to top was earlier reputed by[1]with Obeche sourced from a natural forest in Nigeria.[29]revealed that variation in wood along the axial and radial positions and within the annual rings might be due to genetic, physical or silvicultural treatments.

### Fibre diameter

The mean value obtained for fibre diameterwas 21.31µm. The values in the axial plane were 22.38µm at the base, 21.65µm at the middle and 19.91µm at the top. In the radial positions, the mean ranged from 22.56µm in the outerwood, 21.12µm in the middlewood to 20.26µm at the innerwood (Table 1). The variation pattern showed that fibre diameter generally decreased from base to top and increased from innerwood to outerwood at any particular height (Table 1). The increase from middlewood to outerwood in the fibre diameter agrees with the result of the study carried out by[8] on *Tectona grandis* which had an increase in fibre diameter from pith to barkand disagrees with the inconsistent pattern of variation in *Bombax buonopozense* reported by [18]. The observed variation in fibre diameter in the axial and radial positions may be associated with the increasing age of the trees and the many molecular and physiological changes that occur in the vascular cambium as well as the increase in the wood cell wall thickness during the aging process [30, 23].

**Cell wall thickness**

The mean value for cell wall thickness was 18.31µm. The value ranged from 17.87µm in the top to 18.87µm in the base on the axial plane. In the radial positions the mean value ranged from 16.73µm in the innerwood to 19.88µm at the outerwood (Table 1). The pattern of variation indicates that cell wall thickness decreased from base to the top along the vertical axis. Radially variation increases from innerwood to the outerwood. This pattern of variation agrees with Izekor and Fuwape (2011) in their published work on *Tectona grandis* wood. Similar observation was recorded by [14] on Obeche. He recorded a higher value of 4.6µmat the butt along the axial plane while 3.1µm was recorded at the top 90% of merchantable height.

**Lumen**

The mean for fibre lumen was 18.31µm. Thevalue ranged from 17.87µm to 18.87µm in the axial direction and from 16.73µm to 19.88µm in the radial plane (Table1). The variation pattern was inconsistent in the lumen along the bole as it decreases from the base to the top. The trend in the radial plane was consistent with a steady, but gradual increase from middlewood to outerwood (Table 1). [8] attributed the differences in lumen width to increasing age of the tree.[4] reported positive relationship between variations in lumen width and age of the cambium. The variation in cell wall thickness may be responsible for the changes in lumen width.

Analysis of variance showed that each sampled tree, sampling height, radial position and interaction wasinsignificant in fibre length at 5% probability level. Sampled trees were significant in cell wall thickness and lumen, but were not significant infibre diameter. Sampling height was significant in fibre diameter, cell wall thickness and lumen. In the radial position fibre diameter and lumen was significant and was insignificant in cell wall thickness at 5% probability level (Table 2).

**Radial Shrinkage**

The mean radial shrinkage was 4.47%, ranging from 4.39% in the base to 4.34% in the middle and 4.67% at the top. In the radial position it decreased from 4.68% in the outerwood to 4.47% in the middlewood and 4.26% at the innerwood. The pattern of variation showed that along the vertical axis radial shrinkage was high in the base, it later decreased in the middle and rapidly increased in the top giving an inconsistent pattern of variation. Radially the pattern of variation shows that radial shrinkage increased gradually from the pith to the bark giving an indication of radial uniformity towards the bark (Table 1).

**Tangential shrinkage**

The mean tangential shrinkage was 6.46%. In the axial plane the value ranged from 6.13% at the base to 6.73% at the top. The mean in the radial position ranged from 6.03% in the innerwood to 6.97% in the outerwood (Table 1). The pattern of variation in the vertical axis indicates that tangential shrinkage increased from the base to the top while radially tangential shrinkage decreased from outerwood to innerwood (Table 1).The mean volumetric shrinkagewas 11.32%. Thevalue ranged from 10.79% in the base to 11.93% at the top along the vertical axis. Across the radial plane the value ranged from 10.65% in the innerwood to 12.13% at the outerwood (Table 1). The pattern of variation showed that both the vertical axis and the radial plane varied alike. That is, volumetric shrinkage increased from base to top and from innerwood to outerwood.

**Volumetric shrinkage**

Volumetric shrinkage recorded is approximately the sum of tangential and radial shrinkage. The difference between the longitudinal, radial and tangential shrinkage is due to the alignment of wood cells [9]. As water is removed from the cell walls, the cells move closer together. Movement in the tangential and radial directions is several times greater than in the longitudinal direction [3].Variation in shrinkage in the different directions according to [7] is due to the cellular structure and physical organization of cellulose chain molecules within the cell walls.

Analysis of variance for shrinkage characteristics indicates that sampling height, radial position and sampled trees were significant at 5% probability level while interaction between sampling height and radial position was insignificant (Table 2).

**Table 1: Mean Values of Fibre Dimension and Shrinkage Characteristics of *Gmelina arborea* Wood**

| | | Sampling Height (%) | | | |
|---|---|---|---|---|---|
| Wood Properties | Radial Position | Base (10%) | Middle(50%) | Top (90%) | Pooled Mean ± SD |
| Fibre length (mm) | Outerwood | 1.38±0.09 | 1.33±0.03 | 1.25±0.03 | 1.32±0.05 |
| | Middlewood | 1.27±0.10 | 1.22±0.08 | 1.20±0.03 | 1.23±0.07 |
| | Innerwood | 1.20±0.10 | 1.17±0.08 | 1.16±0.04 | 1.18±0.07 |
| Pooled Mean±SD | | 1.28±0.09 | 1.24±0.06 | 1.20±0.03 | **1.24±0.06** |
| Fibre diameter (µm) | Outerwood | 24.15±1.09 | 22.92±0.68 | 20.61±0.83 | 22.56±0.87 |
| | Middlewood | 21.82±2.77 | 21.60±0.92 | 19.95±0.65 | 21.12±1.45 |
| | Innerwood | 21.18±2.93 | 20.42±0.67 | 19.19±1.16 | 20.26±1.59 |
| Pooled Mean±SD | | 22.38±2.26 | 21.65±0.76 | 19.91±0.88 | **21.31±1.30** |
| Cell wall thickness (µm) | Outerwood | 2.05±0.82 | 1.99±1.07 | 1.83±0.76 | 1.96±0.88 |
| | Middlewood | 1.93±0.82 | 1.86±0.97 | 1.68±0.78 | 1.82±0.86 |
| | Innerwood | 1.70±0.90 | 1.64±0.84 | 1.61±0.64 | 1.65±0.79 |
| Pooled Mean±SD | | 1.89±0.85 | 1.83±0.96 | 1.71±0.73 | **1.81±0.84** |
| Lumen (µm) | Outerwood | 20.71±1.92 | 19.58±1.23 | 19.34±1.67 | 19.88±1.61 |
| | Middlewood | 19.30±2.83 | 17.90±1.34 | 17.78±0.78 | 18.33±1.65 |
| | Innerwood | 16.59±3.54 | 17.12±1.32 | 16.48±0.93 | 16.73±1.93 |
| Pooled Mean±SD | | 18.87±2.76 | 18.20±1.30 | 17.87±1.13 | **18.31±1.73** |
| Radial shrinkage (%) | Outerwood | 4.67±0.23 | 4.54±0.04 | 4.84±0.12 | 4.68±0.13 |
| | Middlewood | 4.35±0.15 | 4.39±0.14 | 4.66±0.41 | 4.47±0.23 |
| | Innerwood | 4.17±0.22 | 4.09±0.36 | 4.51±0.16 | 4.26±0.24 |
| Pooled Mean±SD | | 4.39±0.20 | 4.34±0.18 | 4.67±0.23 | **4.47±0.20** |
| Tangential shrinkage (%) | Outerwood | 6.81±0.28 | 6.80±0.34 | 7.31±0.21 | 6.97±0.27 |
| | Middlewood | 6.06±0.18 | 6.39±0.25 | 6.65±0.36 | 6.37±0.26 |
| | Innerwood | 5.52±0.19 | 6.23±0.64 | 6.33±0.22 | 6.03±0.39 |
| Pooled Mean ± SD | | 6.13±0.22 | 6.47±0.41 | 6.73±0.26 | **6.46±0.89** |
| Volumetric shrinkage (%) | Outerwood | 11.68±0.36 | 12.12±0.82 | 12.58±0.22 | 12.13±0.47 |
| | Middlewood | 10.84±0.53 | 11.04±0.43 | 11.62±0.25 | 11.17±0.40 |
| | Innerwood | 9.85±0.33 | 10.52±0.96 | 11.58±0.42 | 10.65±0.57 |
| Pooled Mean±SD | | 10.79±0.41 | 11.23±0.74 | 11.93±0.29 | **11.32±0.48** |

The results of the regression analysis performed to model the relationship between the dependent variable (Shrinkage Characteristics) and the independent variables are listed in Table 3. Shrinkage characteristics were positively and linearly correlated with fibre length, fibre diameter, cell wall thickness and lumen. The multiple regression which relates shrinkage characteristics to the independent variables applied in this study with their corresponding coefficient of multiple determination ($r^2$) values are as in Table 3 below. Effect of anatomical properties was best observed in volumetric shrinkage with SE of 0.79, followed by tangential shrinkage with SE value of 0.51 and then radial shrinkage with SE of 0.22. The results from regression analysis in this study revealed that some anatomical properties have significant effect to a large extent on shrinkage beharviour.The finding in this study is in agreement with the work of [14]which states that a particular anatomical unit determines wood property singlely or in combination with others is both hereditary and influenced by management practices.This implies that fibre dimensional characteristics jointly affect shrinkage behaviour of wood.The correlation matrix in Table 4 for the independent variables showed a significant relationship. From the various correlation matrices for the dependent variables shrinkage characteristics is positively correlated with the independent variables. The result of correlation analysis between radial shrinkage, tangential shrinkage, volumetric shrinkage, fibre length, fibre dimension, lumen and cell wall thickness indicate that there was significant difference (at $P<0.05$).

**Table 2: Analysis of Variance for Fibre Dimension and Shrinkage Characteristics of *Gmelina arborea* Wood**

| Wood Properties | Source of Variation | Df | Mean Square | F- cal |
|---|---|---|---|---|
| | Trees (Block) | 4 | 0.008 | $0.24^{ns}$ |
| Fibre Length (Fl) | Sampling Height (SH) | 2 | 0.024 | $0.73^{ns}$ |
| | Major plot Error | 8 | 0.014 | |
| | Radial Position (RP) | 2 | 0.073 | $2.21^{ns}$ |
| | Interaction ( SH × RP) | 4 | 0.003 | $0.09^{ns}$ |
| | Sub-Plot Error | 24 | 0.033 | |
| | **Total** | 44 | | |
| | Trees (Block) | 4 | 2.12 | $1.02^{ns}$ |
| Fibre Diameter (Fd) | Sampling Height (SH) | 2 | 23.77 | 11.34* |
| | Major plot Error | 8 | 3.49 | |
| | Radial Position (RP) | 2 | 20.48 | 9.77* |
| | Interaction ( SH × RP) | 4 | 1.2 | $0.57^{ns}$ |
| | Sub-Plot Error | 24 | 2.09 | |
| | **Total** | 44 | | |
| Cell wall Thickness (Cwt) | Trees (Block) | 4 | 6.1 | 3.79* |
| | Sampling Height (SH) | 2 | 0.14 | $0.09^{ns}$ |
| | Major plot Error | 8 | 0.18 | |
| | Radial Position (RP) | 2 | 0.35 | $0.22^{ns}$ |
| | Interaction ( SH × RP) | 4 | 0.01 | $0.07^{ns}$ |
| | Sub-Plot Error | 24 | 1.61 | |
| | **Total** | 44 | | |
| | Trees (Block) | 4 | 15.58 | 16.68* |
| Lumen (lu) | Sampling Height (SH) | 2 | 3.85 | 4.12* |
| | Major plot Error | 8 | 6.19 | |
| | Radial Position (RP) | 2 | 37.2 | 39.84* |
| | Interaction ( SH × RP) | 4 | 1.47 | $1.57^{ns}$ |
| | Sub-Plot Error | 24 | 0.93 | |
| | **Total** | 44 | | |
| | Trees (Block) | 4 | 0.073 | 4.22* |
| Radial Shrinkage (Rs) | Sampling Height (SH) | 2 | 0.46 | 26.59* |
| | Major plot Error | 8 | 0.078 | |
| | Radial Position (RP) | 2 | 0.7 | 40.46* |
| | Interaction ( SH × RP) | 4 | 0.019 | 1.10ns |
| | Sub-Plot Error | 24 | 0.017 | |
| | **Total** | 44 | | |
| | Trees (Block) | 4 | 0.47 | 6.06* |
| Tangential Shrinkage (Ts) | Sampling Height (SH) | 2 | 1.5 | 19.36* |
| | Major plot Error | 8 | 0.086 | |
| | Radial Position (RP) | 2 | 3.46 | 44.64* |
| | Interaction ( SH × RP) | 4 | 0.17 | 2.19ns |
| | Sub-Plot Error | 24 | 0.08 | |
| | **Total** | 44 | | |
| | Trees (Block) | 4 | 0.98 | 5.83* |
| Volumetric Shrinkage (Vs) | Sampling Height (SH) | 2 | 3.51 | 20.91* |
| | Major plot Error | 8 | 0.31 | |
| | Radial Position (RP) | 2 | 10.16 | 60.51* |
| | Interaction ( SH × RP) | 4 | 0.09 | 0.57ns |
| | Sub-Plot Error | 24 | 0.68 | |
| | **Total** | 44 | | |

**Significant difference at 5% probability level*
*ns- non significant difference at 5% probability level*

**Table 3: Regression Equations of dependent and independent variables**

| Shrinkage Property | $b_0$ | $b_1$ | $b_2$ | $b_3$ | $b_4$ | $r^2$ | Std Error |
|---|---|---|---|---|---|---|---|
| RS | 3.8358 | -0.5001 | -0.0684 | 0.1323 | 0.1607 | 0.4459 | 0.2272 |
| TS | 4.9165 | 0.1840 | -0.1115 | -0.1115 | 0.3574 | 0.2698 | 0.5128 |
| VS | 8.7236 | -0.6700 | -0.1869 | 0.3483 | 0.5416 | 0.3398 | 0.7933 |

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + E$

**Table 4: Results of correlation analysis between shrinkage characteristics and the studied variables**

| Variables | Rs | Ts | Vs | Fl | Fd | lu | Cwt |
|---|---|---|---|---|---|---|---|
| Radial shrinkage (Rs) | 1.00 | 0.01 | 0.81* | 0.13 | 0.16 | 0.50* | 0.07 |
| Tangential shrinkage (Ts) | 0.01 | 1.00 | 0.91* | 0.20 | 0.11 | 0.26 | 0.28 |
| Volumetric shrinkage (Vs) | 0.81* | 0.91* | 1.00 | 0.18 | 0.17 | 0.13* | 0.11 |
| Fibre length (Fl) | 0.13 | 0.20 | 0.18 | 1.00 | 0.62* | 0.48* | 0.22 |
| Fibre diameter (Fd) | 0.16 | 0.20 | 0.17 | 0.01 | 1.00 | 0.68* | 0.11 |
| Fibre lumen (Lu) | 0.50* | 0.26 | 0.13* | 0.48* | 0.68* | 1.00 | 0.27 |
| Cell wall thickness (Cwt) | 0.07 | 0.28 | 0.11 | 0.22 | 0.10 | -0.27 | 1.00 |

** Significant at 5% level of probability*

## CONCLUSION

The relationships between fibre properties and shrinkage in 25-year-old *Gmelina arborea* wood were significant at 5% probability level for most of the properties.The studyshowed that Fibre dimension decrease from base to top and increased from innerwood to outerwood. Shrinkage characteristics increase from base to top and decrease from outerwood to innerwood. Effect of anatomical properties was best observed in volumetric shrinkage which was determined by multiple of fibre length, fibre diameter, lumen and cell wall thick. It was followed by tangential shrinkage and radial shrinkage.Positive correlation was established between Fibre dimensional characteristics and shrinkage properties. In view of this large shrinkage, the wood species should be subjected to controlled air seasoning technique to reduce possible drying stresses associated with the high shrinkage. After which the wood could be suitable for veneer, plywood and saw wood manufacture. Positive correlation was established between Fibre dimensional characteristics and shrinkage properties.

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