

Specific Gravity as Wood Quality Attribute of Anthocleista djalonensis -A Tree Lesser-Used-Species in Rivers State

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Abstract
This study was conducted in Tai, Eleme and Obio-Akpor Local Government Areas all in Rivers State, materials were collected from two locations each and to determine the specific gravity of *Anthocleista djalonensis woods* in radial (core wood, middle wood and outer wood near the bark) and axial (top, middle and base) directions. Three standing trees were selected and cut from each diameter classes of 3-10 in, 11-15 in and 16-25 in with a diameter tape at strategic positions of 25%, 50%, and 75% of merchantable. Completely randomized design (CRD) was used as the experimental design with five treatments replicated three times. The results showed that there was significant difference (P≤0.05) between diameter classes (DC) and the locations: (16-25 in) in UST had highest SG (0.72) followed by DC of 11-15in and the lowest 3-10in followed by Eleme with similar trend while Tai (11-15in) class Tai had highest at the top and lowest in the 3-10in diameter class. This showed that there were location and age effects as correlation coefficient (r) among the locations showed high significance between Eleme and Tai (r<0.915**), UST and Tai (r<0.965**) and UST and Eleme (r<0.845**). It is a moderate heavy wood and could be used in service where appearance and dimensional stability are important: it is placed in the n- Millwork/European Joinery Grades - these are tight-knotted materials which can be used or be reconstituted or remanufactured components-engineered wood products (EWP) with no blow effects. Since this species has fairly consistent specific gravity relative to locations, the use of this wood is recommended to wood users.
Keywords: Specific gravity, Anthocleista djalonensis , axial, radial, wood quality

1. Introduction

Physical properties of wood are very basic to the general behaviour of wood; all the physical properties of wood are determined by the factors inherent in its structural organization. Physical properties of wood are expressed in terms of the amount of (a) cell wall substances present in a given volume of wood, (b) the amount of water present in the cell wall, (c) the proportional composition of the quantity and nature of extraneous substances present, (d) the arrangement and orientation of wall materials in the cells and in different tissues and (e) the kind, size, proportion and arrangement of the cells making up the woody tissue (Panshin and Dezeeuw, 1980). Essentially, physical properties of wood are commonly observed in its specific gravity or density, moisture content, and dimensional stability, among others.

Specific gravity is an important physical property of wood which has been used as a good index for predicting wood quality (Ogunsanwo, 2000). This property is also related to a number of solid wood utilization characteristics, as well as the manufacture and performance of reconstituted products.

The specific gravity of wood is also known as the relative density or density index is the amount of wood substance per unit volume and has been described as the most important physical property of wood (Kellog, 1982) and is the most useful descriptor of wood quality (Du Ploy, 1980). It is the single most important predictor of wood strength properties for both dry and green wood. Specific gravity predicts various mechanical properties because it represents allocation to structure—namely, dry biomass per unit volume of live wood.

Although wood quality varies with products and soil properties, several wood properties are indices of quality in most wood based industries are density or specific gravity, cell length especially the length fibres, cell wall thickness, cell lumen and proportions of various cell types e.g. fibre, vessel and parenchyma proportions.

Therefore, to ensure the continuous availability of wood resources and the continuous utilization of tropical species, there is need to shift attention from highly-used-species-HUS to the lesser-used-species (LUS) (Adejoba, and Onilude, 2008), especially those that would meet the industrial requirements of end uses.

The study examined the specific gravity as basic wood quality attributes of the wood *Anthocleista djalonensis* in various locations in Rivers State.

2. Materials and Methods

Gravimetric method developed by Smith (1954) for determination of specific gravity (SG) was used. Trimmed cubes of wood of dimension 20 x 20 x 20 mm were taken from the different parts radially (across the rings-pith to bark) and axially (along the length of trees-top, middle and base). The specimens were completely saturated

by immersing them in water for 48hrs, blotted to remove excess water, weighed and oven-dried to a constant weight at 103^{o}C (Smith, 1954).
Specific gravity was determined using the formula.

$$SG = \frac{1}{\frac{WS-WO}{WO} + \frac{1}{1.53}}$$

Where G = specific gravity
Ws = Saturated weight of wood
Wo = Oven dry weight of wood
1.53 = constant developed by (Stamm, 1929) as the actual weight of wood substance

3. Experimental design/Data analysis

Completely Randomised Design (CRD) was used with five treatments replicated three times. Data were analyzed using one-way analysis of variance (ANOVA) while further analysis was done using correlation analysis.

4. Results and Discussion

Result of the analysis of variance for the specific gravity revealed a significant difference ($P \leq 0.05$) among the locations where the species were sampled.

Specific gravity (SG) ranged from 0.56 to 0.76 increasing from the top to bottom in all the diameter classes (Figure 1), but SG often fluctuated but in most cases increased axially (vertically) with decreased height. The highest was recorded in the 16-25cm diameter class (0.65) in the bottom followed by middle (0.54) and the least top (0.45). This trend was observed in all the other diameter classes in all the locations. The observed trend agreed with Panshin and Dezeeuw (1980) that about two-thirds of hard woods species' in the tropics where specific density appears to be related to fibre characteristics which is attributed to either increasing wall thickness of fibre from the pith to bark or increasing percentage of fibre with little change in the in wall thickness and to increase with increasing tree age due to modifications in the anatomical structure during xylem formation in vascular cambium and by an increment in the thickness of the cell walls and a reduction in the frequency of vessels (Bhat *et al*. 2001). The radial increase from corewood (pith) to the outerwood (bark) is in line with Type 1 variation pattern-increase in specific gravity (SG) from pith to bark (Panshin and Dezeeuw, 1980) and in agreement with the findings of Ola (2003) that reported an increase in specific gravity of *Sterculia setigera* wood from the pith to the bark, Kandeel and Bensend (1995) on silver maple, Xin *et al.,* (1996) on *Pinus radiata* and Akachuku (1984) on *Gmelina arborea.* Similar study has shown that *Ficus mucuso*, a lesser-used wood species possesses a variable specific gravity (Adejoba and Onilude, 2008).

The axial decrease in SG from top to bottom was reported as one pattern of variation (Panshin and Dezeeuw, 1980). The slight decrease in SG from the base to the top is the most commonly reported trend of variation especially in coniferous plants (Ogunsanwo, 2000), this agrees with the report of Fung (1993). According to Panshin and Dezeeuw, (1980) wood with basic specific gravities of 0.36 or less is considered to be light; 0.36 to 0.50, moderately heavy; above 0.50 heavy. Hence, *Anthocleista djalonensis* can be considered to be heavy woods. This is surprising because the wood of the species hitherto has being considered very light but this finding the wood of *Anthocleista djalonensis* is strong and are used in craft and construction of roofs of houses (Personal communication).

The radial increase from corewood to the outerwood is in line with type 1 variation pattern of increase in SG from pith to bark (Panshin and Dezeeuw, 1980).

Specific gravity wood is generally preferred for construction works to provide the strength required, such wood may not be the most desirable for pulp and paper making (Ochnogor and Onilude, 1985).

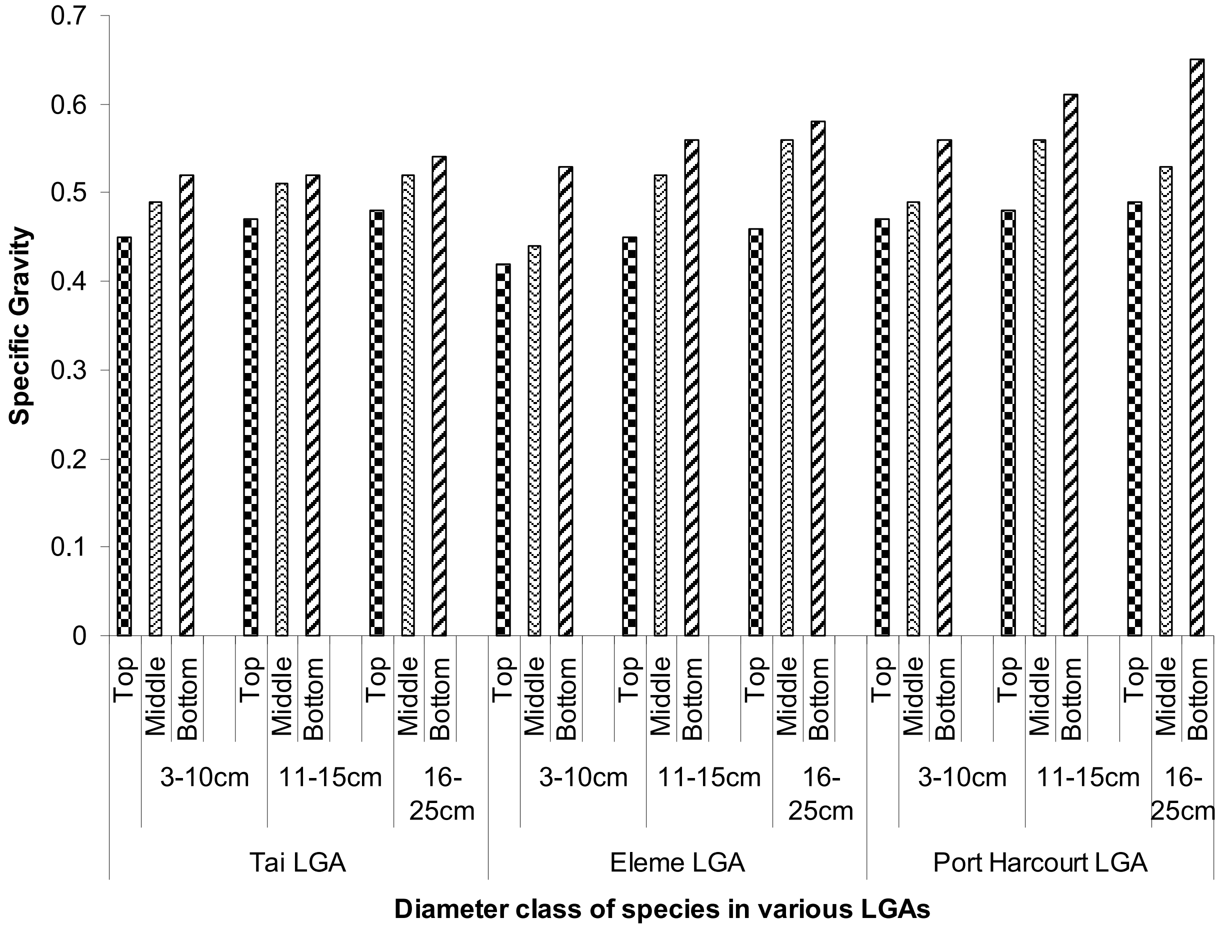

Figure 1: Effects of diameter class on specific gravity at various locations

This showed that there were location and age effects as correlation coefficient (r) among the locations showed high significance between Eleme and Tai (r<0.915**), UST and Tai (r<0.965**) and UST and Eleme (r<0.845**) (Table 1).

Table 1: Correlations Table of Specific Gravity at various locations

		Tai	Eleme	UST
Tai-Pt	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	9		
Eleme	Pearson Correlation	0.915(**)	1	
	Sig. (2-tailed)	0.001		
	N	9	9	
UST	Pearson Correlation	.965(**)	0.845(**)	1
	Sig. (2-tailed)	0.000	0.004	
	N	9	9	9

** Correlation is significant at the 0.025 level (2-tailed).

Axially, *Anthocleista djalonensis* (16-25cm) in UST had highest SG (0.72) followed by diameter class of 11-15cm and the lowest 3-10cm followed by Eleme with similar trend while Tai (11-15cm) class Tai had highest at the top and lowest in the 3-10cm diameter class. Radially, UST had the highest SG of 0.66, 0.68 and 0.72-top, middle and bottom respectively followed by Eleme of 0.62, 0.67 and 0.70-top, middle and bottom respectively and Tai had SG of 0.61 at top, 0.64 at the middle and 0.67 at bottom (Table 1). However, across the rings, the SG was haphazard, highest at near bark and near pith in the species. This agrees with Akachuku (1984) that SG is irregular across rings and along the bole and supported Williamson and Wiemann (2010) that the high variance in specific gravity among species in the tropical areas is present within individual forest stands.

5. Summary and Conclusions

This study has shown that *Anthocleista djalonensis* a lesser-used-wood-species possesses a variable specific gravity of 0.56 to 0.76 falls within the range of wood considered to be heavy wood. These woods are comparable in SG to some economic wood species, such as *Hickory* (0.73) and *Cherry* (0.50). Radially, the specific gravity increased from corewood to the outerwood with a slight decrease in specific gravity from the base to the top shows its dimensional stability.

6. Recommendations

Anthocleista djalonensis is a heavy wood and could be used in windows, doors, furniture, and cabinets, where appearance and dimensional stability are important and finally, from this study *Anthocleista djalonensis* is placed in the n- Millwork/European Joinery Grades - these are tight-knotted materials which can be used (Jozsa and Middleton, 2012) or be reconstituted or remanufactured components-engineered wood products (EWP) with no blow effects.

Since this species has fairly consistent specific gravity relative to locations, silviculturists should endeavour to produce wood that satisfies these requirements to wood users.

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