Production of Fibreboard using wood Residue of Gmelina arborea and Pinus caribaea

Momoh, K. S.[1], Riki, J. T. B[2]* and Oluwadare, A. O.[1]

[1]Department of Forest Production and Products, Faculty of Renewable Natural Resources, University of Ibadan, Ibadan, Nigeria

[2]Department of Forestry and Wildlife Management, Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State, Nigeria

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Abstract: The study was design to evaluate the production of fibreboard using wood residue of *Gmelina arborea* and *Pinus caribaea.* Wood shavings from the selected species were grounded in a hammer mill to obtain two particle sizes of 1 mm and 2 mm. a mould of 310 mm x 310 mm was made to from the boards. Three mixing ratios of adhesive: water was used (1:3; 1:1 and 3:1).The results revealed that there was an increase in the mean density from the lowest concentration ratio of 1:3 to the highest concentration ratio of 3:1 (mixing proportion of adhesive to water).Further test was examined on the swelling and shrinkage properties of the resulting boards of different concentration ratio of adhesives and water. The highest overall noticeable volumetric swelling percentage was found in *Gmelina arborea* of the particle size 1mm with mixing proportion of 3:1 adhesive to water, which increased by 5.01%, and the overall noticeable lowest swelling concentration ratio was found on *P. carribaea* of 1:1 with 2mm particle size which increased with 1.15%. In addition, the highest overall noticeable volumetric shrinkage percentage was found in *P. carribaea* of the concentration ratio 1:1 of particle size 2mm which shrinked by 20.44%, and the overall noticeable lowest shrinkage concentration ratio was found in *Gmelina arborea* of particle size 1mm with the mixing ratio of 1:1 which shrinked by 8.57%.

Keywords: Fiberboard, Density. Swelling, Shrinkage, *Gmelina arborea, Pinus caribaea*

INTRODUCTION

The growing demand for wood and wood based panels, its increasing scarcity as well as its potentials of competing as substitute to products such as plastic, iron and steel, call for the most economic use of wood fiberboard as a construction material. Proper utilization of fiberboard in this respect demands a full knowledge of its method of manufacture and its physical and mechanical properties which can only be obtained through research. Standard tests on small clear specimens of fiberboard provide the basic information for this determination (Sadanandan-Nambiar, 2019). Generally, fiberboard products can be used in indoor and outdoor decoration, office and high grade furniture, interior decoration of cars and electronics industry. It also serves as good production materials for flooring, wall paneling.

Over the years, most of the wood wastes generated from sawmilling industries in developing countries like Nigeria, are largely used as fuel for domestic use. Although, on a small scale the wastes have been used in the production of briquette as a fuel for domestic use. Some of these wastes (sawdust, wood shavings and wood offcuts) are also sometimes collected by poultry farmers for floor layering of poultry pens. The poor long conversion technique adopted in most sawmills in Nigeria is partly responsible for inadequate supply of required lumber

The manufacturing of fiberboard from wood fiber with the help of adhesive is highly developed and widely commercialized technique. However, with an increasing concern over health issues and biomass conservation, the fiber boards from agriculture residues with or without using adjesives are under intensive investigation. In last three decades, several researches have been done with various methods and technique dealing the development of bioadhesive based fiber boards (Nasir *et al.,* 2021). The sustainable future of contemporary society has been compromised due to environmental pollution from industrial systems and the generation of solid waste. Consequentially, the managed exploitation of natural resources to a sustainable level within the Earth's capacity remains a present and future challenge. Furthermore, the pursuit of materials free from toxic substances made from renewable sources is a tendency towards effective cleaner production and waste management (Jung *et al.,* 2021).

There is a sharp decrease in the production of wood from natural forests due to increase in population and advancement in technology while as, the use of fiber from residues is expected to mainly increase in order to both meet societies demands for building and engineering materials and to help in solving from disposal the agricultural wastes. Producing Particle board was the most suitable means to convert these wastes into materials with economic value that contribute to improve the environment and increase the self-sufficiency, Hassan *et al.,* (2014).

Several countries utilized agro fibers for the production of particle board or other composite panels. So far there are at least 30 plants that utilize agricultural waste materials in the production of particle boards around the world (El-Sayed *et al.,* 2021). On the other hand Alexandru (2002), sawdust is generally considered as a timber-industrial waste that pollutes the environment , but can become a valuable commodity either as a raw material in manufacturing industries for wood boards, light construction materials such as shelves, wall and roof sheeting. Moreover, Rofii *et al.,* (2013) studied the use of furniture mill residues containing high density raw materials in particle board production and to evaluate the effect of mixing several types of furnish on board performance. Resin was applied at 6 % content in mat preparation. The pressing conditions were temperature of 180 °C, initial pressure of 3 MPa, and pressing time of 5 minutes. They found that all residues from furniture mills have the potential to be used for particle board production. Furthermore, Hamid (2007 and 2008) fresh wood and urea-formaldehyde are needed as a synthetic adhesive system and other fossil-based adhesive systems. Research related to this focused on the manufacture of granular panels from agricultural waste bonded by urea formaldehyde. Manufacture granular panels from cotton stalks as well as medium density fiberboard (MDF) sheets with urea-formaldehyde. Okai *et al.,* (2015) determined that the potential of utilizing agricultural residues such as corn stalk for particle board manufacturing with the aim of reducing pressure on tropical forests. The improper disposal of these wastes has many negative environmental consequences. For instance, burning these wastes leads to increased levels of carbon dioxide in the atmosphere, which contributes to global warming (Ayinde e*t al.,* 2020).

Fiberboard is a panel material made from wood fiber with the addition of urea formaldehyde and or other synthetic resin, and subsequently, the mats produced are compressed in pressurized heat condition. According to Kariuki (2019), it is a panel product manufactured from lignocellulosic fiber combined with a synthetic resin such as urea-formaldehyde (UF) resin, phenol-formaldehyde (PF) resin, or isocyanate binder under heat and pressure with the presence of moisture. Fiberboard was coined from the utilization of particleboard in which the difference lies in the reduction of wood chips of the wood to be used. Generally, fiberboard products can be used in indoor and outdoor decoration, office and high grade furniture, interior decoration of cars and electronics industry. It also serves as good production materials for flooring, wall paneling among others. Fiberboard is normally classified by density and can be made by either dry or wet processes. Dry processes are applicable to boards with high density (hardboard) and medium density (MDF). Wet processes are applicable to both high-density hardboard and low-density insulationboard. Wet process fibreboards can be classified according to their density: Hardboards > 900kg/m^3, Medium boards > 400kg/m^3 to < 900kg/m^3 and Softboards> 230kg/m^3 to <400kg/m^3 (Mathias and Michaud, 2016). One of the ways of utilizing this percentage wastage of wood is through production of fiberboard using wood residues as raw material. The uniform fiber distribution of fiberboard in there structure meet most end-use requirement (Atanu *et al.,* 2013). This study was carried out to show how fiberboard is been made as well as comparing different level of concentration of binding agent as they affect the physical and mechanical properties of fiberboards.

MATERIALS AND METHODS

Study Area

Sawdust of *G. arborea* and *P. carribaea* were obtained from Forest Production and Products wood workshop Faculty of Renewable Natural Resources, University of Ibadan, Ibadan Nigeria. University of Ibadan campus is located north of Ibadan along Oyo road at approximately latitude 7.026’45”-7027’31”N and longitude 3053’31”-3054’14”E South Western region of Nigeria. It is at altitude of 277m above sea level (UIMP, 2013).

Sampling Techniques

The fiberboard produced was a form of modified hardboard for the production of ceiling board, using wet press method.

The materials used for the manufacture of fiberboard include:

- Wood fiber: The sawdust and wood shavings were collected from wood workshop of Department of Forest Resources Management wood workshop, University of Ibadan.
- Hammer mill: It's an electrical machine which was used to reduce the wood shavings into smaller sizes.
- Grinder: Its also an electrical machine which was used to reduce the particles to much smaller size that can allow to pass through the sieve.
- Mould: Six moulds of size 31x31cm were constructed using waste woods and plywood. The wood were filed into a desired thickness of 0.7cm (7mm) all round to give a square shaped thickness, after which two (2) desired length were measured of size 33x33cm and another 2 desired length of 31.4x31.4cm. These extras were made to allow for proper merging in which allowed for the 31x31cm size to mapped out and created inner part for the wood to be properly fixed.
- Sieve: Sieve size was constructed by 1mm and 2mm separately which was used to separate the fiber size into different sizes and served as a defibrator.
- Bonding agent/adhesive: This was used as binder for holding the fibers together using fevicol which is an urea formaldehyde synthetic resin.
- Compressor: This was used to compact the fiber before curing, this actually dictated the density of the boards.

FIBERBOARD MANUFACTURING PROCESS

A. Collection of wood-based raw materials:

Producing quality fiberboard begins with the selection and refinement of the raw materials, most of which are recycled from shavings and chips reclaimed from sawmills and plywood plants. The sawdust and shavings *were G. aborea* and *P. caribean*, which were collected at the Department of Forest Production and Products wood workshop, University of Ibadan.

B. Grinding of material collected

Wood shavings collected were grinded into semi smaller particles with Hammer mill, after which it was grinded into much smaller particle size by Grinding machine.

C. Defibration or refining of wood particles:

Material was collected and sieved into different sizes of 1mm and 2mm (sieve-net size) each species (*i.e Gmelina* and *Pine* differently).

D. Weighing of materials

After the wood shavings had been grinded and sieved into different sizes each species, they were weighed to match the mould of 31x31cm made. The following are mass of particles needed for the Mould size:

Table 1*:* Mass of each particle size

Species	Particle size	Mass
Gmelina arborea	2mm	131g
	1mm	182g
Pinuscarribeae	2mm	148g
	1mm	200g

E. Soaking of the sieved material

After the particles had been weighed, they were soaked with water for about 2-3 hours to allow easy mixing with the binder, ease of compression and ease of mat formation.

F. Blending/ Addition of adhesives:

After the soaking, the water was drained very well and adhesive was added at different concentrations (adhesive x water) as follow:

Table 2: Mixing proportion of adhesive to water in milliliter and ratio

Species	Particle size	Conc.of adhesive and water (ml)	Conc. Ratio of adhesive and water
Gmelina arborea	1mm	100x300	1:3
		200x200	1:1
		300x100	3:1
	2mm	100x300	1:3
		200x200	1:1
		300x100	3:1
Pinus carribaea	1mm	100x300	1:3
		200x200	1:1
		300x100	3:1
	2mm	100x300	1:3
		200x200	1:1
		300x100	3:1

G. Mat formation

The fiber was spread on the mould after the addition of adhesive to produce a mat of uniform thickness (7mm) and to take on the mould size and pattern.

H. Pre-press:

The mat was covered by the mould-cover and was pressed by exerting human weight of 61kg for 5-8 minutes through several pressing steps to produce a uniform density and more usable size.

I. Wet press:

Instead of hot press, I used a modified method which is wet press process, in which the board formed is finally press to desired thickness (modified hardboard) by placing a heavy material of about 80kg for 9-10 hours.

J. Drying

After it was pressed, I subjected it to sundry for 72 hours (for pine) and 96 hours (for gmelina) which made the adhesive to be cured.

K. Trim saw:

The board was trim-sawn to give a fine edge surface.

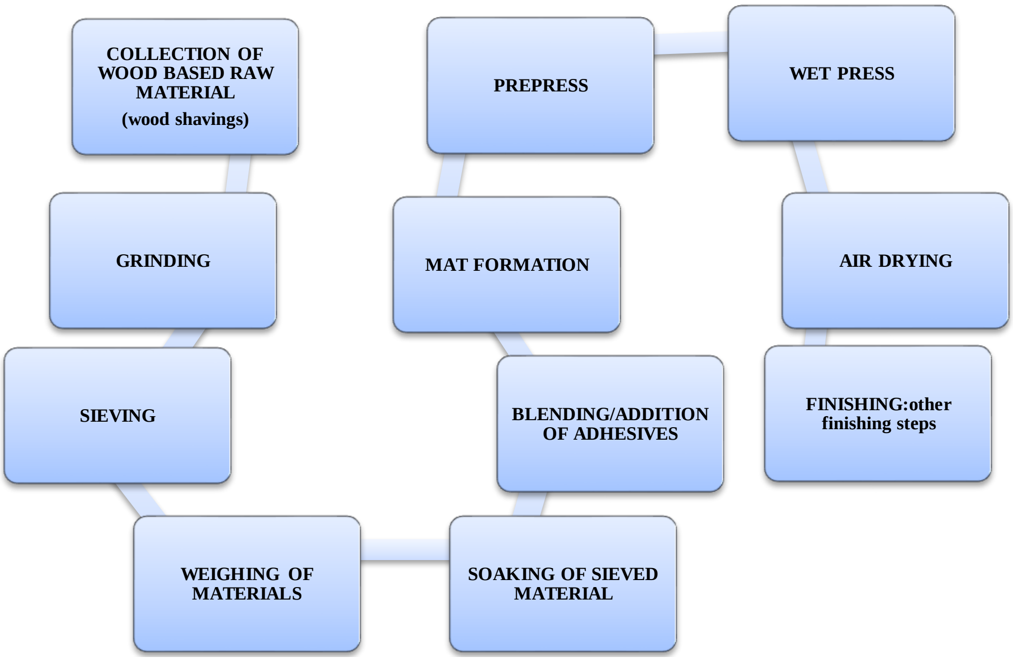

Figure 1: Flow chart of Fiberboard manufacturing

DATA PROCUREMENT PROCEDURE

Twelve boards were manufactured of the size 30cm x 30cm with each having three concentrations (A=1:3, B=1:1, and C=3:1) of Adhesive: Water. Each board was replicated three times in which physical properties were carried out.

The various properties that were scientifically carried out are:

Physical properties:

- Density: which is given as
  $\rho = \frac{m}{v}$……………………………………………………………Eqn. 1
  Where ρ = density
  m= mass
  v= volume
- Swelling: is given as
  $H = \frac{W_1 - W_O}{W_O} X100$…………………………………………………Eqn. 2

Where W_1= final swelling thickness of test piece

W_0= initial thickness of test piece

The swelling was carried out by complete immersion of the samples inside water in which the weights and the dimensions were checked at the interval of 20 minutes and 60 minutes. The swelling was carried out by oven drying the samples at 90°C after reaching the saturated point when immersed in water. The first reading was taken at 1 hour while last reading was taking at 3 hours minutes.

- Shrinkage: is given as:

$S(\%) = \frac{D_s - D_O}{D_s} X100$………………..…………………………Eqn. 3

Where D_s= dimension at saturation condition

D_o= dimension at oven dry condition

$VS= S_r+S_t$..4

Where VS= volumetric shrinkage

S_r= radial shrinkage

S_t= tangential shrinkage

Data Analysis

The testing data were statistically analysed using Statistical Analysis System (SAS) software using Analysis of Variance (ANOVA) and Least Significant Difference (LSD) method for mean separation

RESULTS

Basic Density of the Boards

In this study, it was observed that the basic density of the boards made from the species of *G. arborea* and *P. caribaea* of different mixing ratio varied. As shown in Table 3, it implies that the mean of *G. arborea* of particle size 1mm with mixing proportion of 1:3 adhesive to water was 0.213±0.007(g/cm³) with the standard deviation and variance of 0.0115 and 0.0001 respectively; mean of the mixing proportion of 1:1 adhesive to water was 0.263±0.008(g/cm³) with the standard deviation and variance of 0.0153 and 0.0002 respectively, while the mean of the mixing proportion of 3:1 adhesive to water was from 0.2967±0.0067 with the standard deviation and variance of 0.0115 and 0.0001 respectively.

The mean of *G. arborea* of particle size 2mm with mixing proportion of 1:3 adhesive to water was 0.203±0.003(g/cm³) with the standard deviation and variance of 0.058 and $3.3*10^{-5}$ respectively; mean of the mixing proportion of 1:1 adhesive to water was 0.22±0.012(g/cm³) with the standard deviation and variance of 0.02 and 0.0004 respectively, while the mean of the mixing proportion of 3:1 adhesive to water was 0.243±0.009(g/cm³) with the standard deviation and variance of 0.0152 and 0.0002 respectively.

The mean of *P. caribaea* of particle size 1mm with mixing proportion of 1:3 adhesive to water was 0.326±0.021(g/cm³) with the standard deviation and variance of 0.0379 and 0.0014 respectively; mean of the mixing proportion of 1:1 adhesive to water was 0.377±0.012 with the standard deviation and variance of 0.0208 and 0.0004 respectively, while the mean of the mixing proportion of 3:1 adhesive to water was 0.403±0.0133(g/cm³) with the standard deviation and variance of 0.0230 and 0.0005 respectively.

Finally, the mean of *P. carribeae* of particle size 2mm with mixing proportion of 1:3 adhesive to water was 0.297±0.018(g/cm³) with the standard deviation and variance of 0.0321 and 0.0010 respectively; mean of the mixing proportion of 1:1 adhesive to water was 0.323±0.015(g/cm³) with the standard deviation and variance of 0.0252 and 0.0006 respectively, while the mean of the mixing proportion of 3:1 adhesive to water was 0.397±0.0219(g/cm³) with the standard deviation and variance of 0.0378 and 0.0014 respectively.

(a) *Mat formation* (b) *Drying after been pressed*

Figure 2: Final stage of Fibreboard produced from of *Gmelina arborea* and *Pinus caribaea.*

Table 3: Basic Density of Boards made from the Sawdusts selected species of G. Arborea and P. Caribaea

Species	Particle size (mm)	Concentration ratio 1:3	1:1	3:1
Gmelina arborea	1	0.213±0.007	0.263±0.009	0.297±0.007
	2	0.203±0.003	0.220±0.012	0.243±0.009
Pinus caribaea	1	0.327±0.022	0.377±0.012	0.403±0.013
	2	0.297±0.0186	0.323±0.015	0.397±0.022

Swelling

Results in Table 4, shows the relative percentage swelling of the mean of each concentration ratio at the final reading i.e 60 minutes across the longitudinal, tangential and radial axis which also enabled the volumetric swelling to be calculated.

The swelling was observed at the longitudinal, tangential axis with very little changes along the radial axis. The particle size 1mm of *G. arborea* shows that the mean volumetric swelling of 1:3 (adhesive : water ratio) was 4.29±2.02, for the 1:1 was 3.30±0.90 and for the 3:1 was5.02±1.11, which implies that there was no significance difference in the swelling property (*P* value 0.72).

The particle size 2mm of *G. arborea* shows that the mean volumetric swelling of 1:3 (adhesive : water ratio) was 4.29±0.40, for the 1:1 was 2.26±0.71 and for the 3:1 was3.08±0.31, which implies that there was significance difference in the swelling property (*P* value 0.03).

The particle size 1 of *P caribaea* shows that the mean volumetric swelling of 1:3 (adhesive : water ratio) was 2.05±0.80, for the 1:1 was 3.22±0.06 and for the 3:1 was3.49±0.98, which implies that there was no significance difference in the swelling property (*P* value 0.43) while the particle size 2 of *P. caribaea* shows that the mean volumetric swelling of 1:3 (adhesive : water ratio) was 4.29±0.40, for the 1:1 was 1.16±0.76 and for the 3:1 was3.35±1.36, which implies that there was no significance difference in the swelling property (*P* value 0.33).

Table 4: Mean Swelling of the Boards

Species	Particle size	Conc. ratio of adhesives to water	L swell (%)	T swell (%)	R swell (%)	Vol Swelling (%)
Gmelina arborea	1	1:3	3.07±2.01	1.21±0.02	0.001±0.0002	4.29±2.02
		1:1	0.92±0.45	2.38±1.35	0.001±0.0001	3.30±0.90
		3:1	2.21±0.14	2.81±0.97	0.001±0.0003	5.02±1.11
	2	1:3	1.00±0.15	3.28±0.54	0.002±0.001	4.29±0.40
		1:1	1.64±0.47	0.62±0.39	0.001±0.0001	2.26±0.71

		3:1	1.68±0.44	1.40±0.13	0.0004±0.00001	3.08±0.31
Pinus caribaea	1	1:3	0.76±0.25	1.29±0.55	0.0006±0.0005	2.05±0.80
.		1:1	1.60±0.23	1.62±0.18	0.002±0.0001	3.22±0.06
		3:1	1.28±0.13	2.21±0.85	0.0007±0.0002	3.49±0.98
	2	1:3	1.33±0.30	1.76±0.17	0.001±0.0009	3.09±0.47
		1:1	0.30±0.29	0.85±0.47	0.001±0.00004	1.16±0.76
		3:1	1.56±0.24	1.79±1.12	0.0004±0.0001	3.35±1.36

L, T and R = Longitudinal, Tangential and Radial dimension

Shrinkage

Table 5 shows the relative percentage shrinkage of the mean of each concentration ratio at the final reading *i.e* 120 minutes across the longitudinal, tangential and radial axis which also enabled the volumetric shrinkage to be calculated. The shrinkage was noticed majorly at the radial and tangential axis with little changes along the longitudinal axis. The particle size 1 mm of *G. arborea* shows that the mean volumetric shrinkage of 1:3 (adhesive:water ratio) was 9.87±1.91, for the 1:1 was 13.26±3.63 and for the 3:1 was16.08±2.81, which implies that there was no significance difference in the swelling property ($p > 0.42$).

The particle size 2mm of *G. arborea* shows that the mean volumetric swelling of 1:3 (adhesive :water ratio) was 19.51±6.77, for the 1:1 was 8.57±0.08 and for the 3:1 was18.68±11.89, which implies that there was no significance difference in the swelling property ($p<0.60$). The particle size 1mm of *P. caribaea* shows that the mean volumetric swelling of 1:3 (adhesive : water ratio) was 12.39±4.62, for the 1:1 was 18.71±0.29 and for the 3:1 was14.13±4.11, which implies that there was no significance difference in the swelling property ($p>0.51$), while for The particle size 2mm of *P. caribaea* shows that the mean volumetric swelling of 1:3 (adhesive:water ratio) was 12.44±4.42, for the 1:1 was 20.44±2.52 and for the 3:1 was8.77±2.13, which implies that there was no significance difference in the swelling property ($p>0.16$).

Table 5: Mean shrinkage of the Boards

Species	Particle size	Conc. ratio of adhesives to water	L shrink (%)	T shrink (%)	R shrink (%)	Vol Shrinkage (%)
Gmelina arborea	1	1:3	1.70±1.62	1.27±0.63	6.90±0.34	9.87±1.91
		1:1	0.35±0.24	1.79±0.16	11.11±3.71	13.26±3.63
		3:1	1.94±0.32	1.66±0.48	12.47±2.65	16.08±2.81
	2	1:3	2.06±0.97	2.47±0.70	14.99±5.15	19.51±6.77
		1:1	1.14±0.18	2.56±0.40	4.88±0.50	8.57±0.08
		3:1	1.44±0.20	1.05±0.19	16.19±11.91	18.68±11.89
Pinus caribaea	1	1:3	0.78±0.37	2.02±0.07	9.59±4.32	12.39±4.62
		1:1	1.17±0.06	1.16±0.31	16.39±0.66	18.71±0.29

		3:1	1.32±0.12	1.67±0.09	11.13±4.07	14.13±4.11
	2	1:3	0.60±0.19	3.14±2.18	8.69±2.43	12.44±4.42
		1:1	0.77±0.37	2.29±0.80	17.38±3.69	20.44±2.52
		3:1	1.34±0.35	2.25±0.29	5.19±2.20	8.77±2.13

L, T and R = Longitudinal, Tangential and Radial dimension

DISCUSSIONS

Density

Density is the simplest and most useful single index to the suitability of any material for various uses (Riki *et al.,* 2019). Generally, the results observed in this study which ranges from 0.203±0.003 to 0.297±0.007(g/cm³) for *G. arborea* full within 0.27 – 0.33 g/cm³ recorded in effects of particle sizes and mixing ratios on physical and mechanical properties of particle boards produced from *G. Arborea* modified cassava starch (Ayinde e*t al.,* 2020). Similarly, *P. carribeae* mean densities ranges 0.297±0.0186 to 0.403±0.013g/cm³. The fibreboard using wood residues of *Gmelina arborea* and *Pinus caribaea* all fall within Softboard (≥ 0.23 g/m³ up to < 0.04g/m³) according to density classification (Anderung, 2021). Softboard is generally used as insulating board due to its thermal and acoustic properties. The low densities could be attributed the blowing problems to the interaction between mat moisture content and board and the particle densities during hot pressing (Moslemi, 1974).

It was also, noticed that the higher the proportion of adhesive to water, the higher the density of the board. This concurs with the study carried out by Atanu *et al.,* (2013), they stated that adhesive of different concentrates of Urea Formaldehyde (UF) influences the physical and mechanical properties of bagasse medium density fibreboard. Binding agent helps to achieve strong bonds and compactness with particles causes increasing of density of a board (Ajayi *et al.,* 2008).

Swelling

Wood normally shrinks as it dries and swells as it absorbs moisture. These changes in its dimensions are of importance to anyone who uses wood whether for wood composites or ships building, because wood readily takes on or gives off moisture, even from the atmosphere (Jones and Brischke *et al.,* 2017). The swelling property of any wood composites material is usually done along the longitudinal, tangential and radial axis. This shows the extent in which the material can retain moisture before getting to the point of destruction by moisture. The volumetric swelling recorded for *G. arborea* range 2.26±0.71 to 4.29±2.02% while that of *P. caribaea* range between 1.16±0.76 to 3.49±0.98%. The values are lower than 5.746±0.89 to 7.05±0.34% recorded in *G. arborea* for particle board production using cassava starch as binder. The low density recorded could as a result of the binder and difference in types of board. Panels of such percentages can be fitted for general purpose and furniture use and can also be classified

as structural use panels or special structural use panels used in dry conditions, which require thickness swelling values after 24hours of immersion below 16% and 15%, respectively (EN, 2003).

As indicated from the results, the highest overall noticeable volumetric swelling percentage was found in *G. arborea* at the concentration ratio of 3:1 which increased or swollen by 5.01%, and the overall noticeable lowest swelling concentration ratio was found on *P. caribaea* of 1:1 which increased with 1.15% as such, more dimensionally stable boards were produced at these levels as they showed relatively better performance of thickness swelling of the manufactured boards (Adelusi *et al.,* 2019).

Shrinkage

As mentioned on swelling, the shrinkage property of any wood composites material is also usually done along the longitudinal, tangential and radial axis. This shows the extent in which the materials can expel out moisture. This implies the available moisture was drained below the Fibre Saturation Point (*i.e* 25-30%) (He *et al.,* 2016). The highest overall noticeable volumetric shrinkage percentage was found in *P. caribaea* of the concentration ratio 1:1 which shrinked by 20.44%, and the overall noticeable lowest shrinkage concentration ratio was found in *G. arborea* of 1:1 which shrinked with 8.57%. The high volumetric shrinkage percentage observed in *P. caribaea* could be attributed to manufacturing parameters (EN, 2003). There is need to air dry the boards produce from this species to avoid shrinkage and swelling while in service (Riki *et al.,* (2021).

CONCLUSION

The results obtained in this study reveals that the quantity of adhesive used in producing fiberboard has an effect in the density of boards. There was an increase in the mean density of the fiberboard from the lowest concentration ratio of 1:3 to the highest concentration ratio of 3:1(concentration of adhesive to water). Notable changes in the dimension of the board were noticed, it was noted also that the concentrations of adhesive used for the manufacture of the fiberboard had no significant difference in the shrinking property, but there was a significant difference on the swelling property of *G. arborea* of particle size 2mm. This implies that when manufacturing fiberboard, anti-swelling or water resistant agents such as wax should be blended with the fiber to reduce the water absorption and shrinking of the resulting fiberboard. Mechanical properties of the boards should be determined to know the inherent strength properties and manufacturing of the board using mixing proportion of different wood shavings

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