ENERGY AND COMBUSTION POTENTIALS OF SOME SELECTED TROPICAL FUELWOOD SPECIES IN IKWUANO LGA, ABIA STATE

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ABSTRACT

This study aimed at assessing the energy, and combustion potential of some selected tropical fuelwood in Ikwuano, Abia State. The study sampled, four micro communities from four major communities of Ikwuano: Ibere (Itunta), Oboro (Umugbalu), Ariam (Ekpiri) and Oloko (Nchara). Major locally wood species (Ukwa (Dialum guineense), Icheku (Pterocarpus species), Cocoa (Theobroma Cacao), Ube (Dacryodes edulis), Umummiri (Morinda coreia), Ojii (Milicea excelsa), Ububa1 (Anthonotha macrophylla), Ububa2 (A. crassifolia), Obia (Caloncoba welwitschii), Oron (Cnestis ferrugina)) used across these communities were collected for laboratory analysis on the proximate and combustibility parameters. From the result, Ash ranges from 2.69% for Mkpe to 3.43% for Icheku. Ash values across the sampled wood species showed a significant difference (p<0.05). Volatile Matter ranges from 83.35 for Cocoa to 87.18 for Ojii. Effect of difference in volatile Matter of wood varied significantly (p<0.5). From the result, Pyrolysis oil ranges from 24.70 % of Ojii to 33.08 % of Icheku. The firewood value index (FVI) of the wood samples. Ubube, and Cocoa had at above 20 %, were the best FVI recorded. The least FVI was recorded by Mkpe at less than 5 % FVI. The proximate data revealed that ash was relatively low across the sampled fuelwoods. However, Icheku, Obia and Ububa 2 were higher in ash levels. The calorific values of the hybrid fuelwood samples in this study are adequate to sustain combustion and produce heat enough to cook, potentially providing an energy source. The fixed carbon although varying significantly (p<0.05) were within same levels. The volatile matter was above 80 % in all the samples. In the sampled communities, type of fuel wood used varied by availability and forestry ecosystem these communities. Rural community dwellers could use this fuel as alternative because of its other fuel sources value even though it is not the only determinant of the choice of wood in preference to wood.

KEYWORD: *Combustion, Tropical, Fuelwood, Energy, Ikwuano, Abia*

INTRODUCTION

Combustion with energy recovery involves the burning of wood wastes and transferring the heat produced to water for the purpose of generating steam in boiler super-heater tubes. The steam may be used to generate electricity in a steam turbine generator or sold directly for commercial

or process heat purposes (Orea *et al*., 2004). Gasification converts wood waste into synthetic gas which can be utilized to produce steam in boiler superheater tubes, to generate electricity directly in an internal combustion (IC) engine or as transportation fuels. Pyrolysis converts wood waste into bio-oil and biochar from which energy and transportation fuels can be obtained. Borrello *et al*. (2023) state that Biomass constitutes up to 12 to 15 percent of the world energy needs. In most countries like Nigeria Biomass have remained 80 % of the major sources of energy (Neina *et al*., 2020).

According to Aina (2016), the overlooked tree species of the tropics if properly harnessed through establishment of extensive energy plantation or tree reintroduction could serve as a major economic gain and energy source. They stated that various tropical trees have several combustive properties in their tissues (Bark, Sapwood and Heartwood). They went forward to explain that combustive characteristics of a wood lies heavily on tree species or tissue types, density, and ash content. According to Desta and Ambaye (2020), tree species of Eastern Africa had high relative moisture and volatile matter but low fix carbon content. FAO (2011) and May-Tobin (2011) revealed that up to 2 billion people depend on forest goods such as fruits, game meat, fibres, and fuel wood to meet their basic needs. FAO (2011) assumes that phyto-fuel harvesting in emerging nations is so essential that it competes with other means of industrial energy like electricity, principally among poor populace in rural areas (Łaska and Ige, 2023).

In recent times in Nigeria, cost of energy alternatives like gas and kerosene have gone up due to unavailability of the product, increase in exchange rate and hence, importation cost and largely lack of local refining power. This has however, widened the gap in purchasing power of middle and lower class citizen in industrialized energy source, thereby putting high burden on the need to utilize biomass of the tropical forest for energy. According to Deka *et al*. (2007), demand for fuelwood is likely to persist as the most significant energy source for rural areas of several nations similarly Aina, (2016) stated that energy consumption varies from place to place and is basically determined by the level of development and availability.

The high use of tropical trees for fuel purposes stretches on the forest biodiversity and being an employer of labour, clothing, building, and drug production base of every economy. It is therefore a cause for worry on the depletion potentials of the forest woods, if measures of identification, and characterization of this forest trees are not done for possible multiple planting as a conservative method, the problem will persist. Sustainable forest management is very important for food security, health and wellbeing of the forests, supply of good quality fresh water, protection against natural hazards such as flood, soil erosion, and protection of soil water and for combating desertification. Forest provides employment and income for the teaming population. consequences of unsustainable forest management are centred towards many problems as follows: Desertification: this refers to the land degradation occurring in arid and semiarid regions and dry sub-humid regions resulting from different factors such as climate variability and human

activities in an attempt to exploit forest resources for livelihood, where this occur there will be fast decline in forest vegetation and resulting to desertification (Łaska and Ige, 2023).

Majority of studies placed more emphasis on describing the desirable criteria for quality wood-charcoal as having high fixed carbon, low moisture and ash contents and volatile matter content (Ijagbemi *et al*., 2014). These are commonly exploited to account for the calorific/heating value of wood-charcoal. However, often overlooked is the influence of the tree species, its ecology, anatomy genetics, inorganic components, such as proximate properties on combustion and fuel properties of wood-charcoal. Little research has been done on tropical tree characterization, combustion, and its chemical properties in Ikwuano Local Government Area of Abia State. Suggesting that a low literature knowledge exist on the potentials of tropical forest tress to this regard, Hence, need to study it can never be said to have been over emphasized. This study aims to characterize energy, and combustion potential of some selected tropical fuelwood in Ikwuano, Abia State.

MATERIALS AND METHOD
Study Area
The study was conducted in Ikwuano Local Government Area in Abia State, Nigeria. Ikwuano LGA is geologically situated in the Eastern Niger Delta and lies within latitudes 5º20' and 5º32' N, and longitudes 7º32' and 7º40'E (Figure 1). It has high relative humidity values over 70 % and is characterized by high temperatures of about 29 ℃ – 31 ℃. Ikwuano Local Government Area of Abia state, Nigeria is bounded in the north and north- east by Bende, in the north by Umuahia-North, in the north-west by Umuahia–South, in the west by Isiala-Ngwa North Local Government Areas respectively; and in the east and the south by Akwa-Ibom state of Nigeria (Uhegbu *et al*., 2014).

The area is endowed with natural springs and streams including Onu-Inyang River which flows from Bende (the northern boundary) through the study area in a south-westerly direction; while Iyinta-Ocha River flows from the central part (Isiala) through south-western part (Ogbuebule) into Akwa-Ibom state on the western flank. On the other hand, Anya River traverses the entire western flank of Ikwuano and joins with Ahi (the westernmost counterpart). This confluence together with others is a main tributary of the great Kwa Ibo River of Akwa Ibom and Cross River States of Nigeria (Uhegbu *et al*., 2014). The main occupation of Ikwuano people is farming. The soil of the L.G.A is fertile though slightly acidic. The major food crop grown are cassava, yam, vegetables, maize etc, while tree crops grown mainly are cocoa, rubber and oil palm. Various kinds of livestock and poultry are also raised by Ikwuano people (Arigbo and Ifenkwe, 2013).
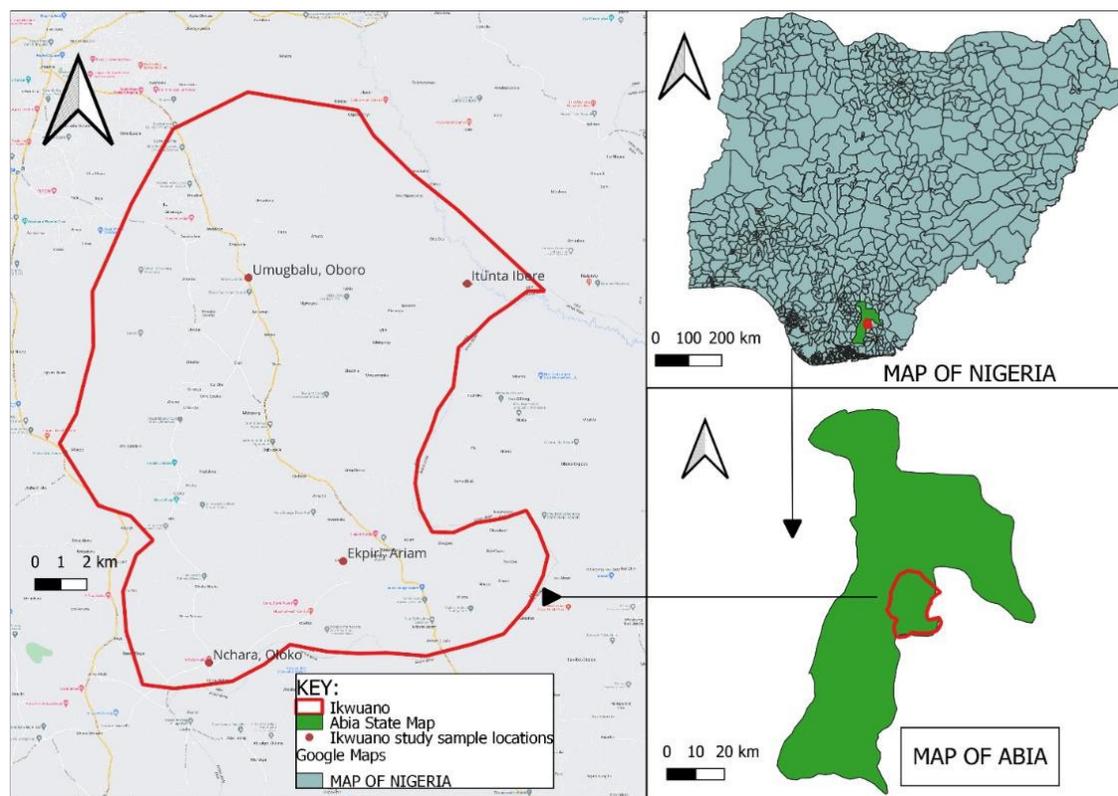
Fig. 1: Map of the study area showing the sampling locations in Ikwuano, Abia, Nigeria

Identify and Characterized Tropical Trees

This was achieved with help from community forest guards for identification of in use firewood species. Local name of tree, pictures and leaf samples of the tree was collected and properly taken to a plant taxonomist for identification in the department of Plant Science and Biotechnology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Collected samples were sun dried, the prepared samples were sent to the laboratory and used for the experimental analysis.

Energy Potential of Fuelwood Species

This study adopted the methods by Desta and Ambaye (2020) with some modification. This involved physical parameter check, Proximate, volatile matter content analysis. From the

identified trees species, a disk of 20 cm height was made from the branch of each tree. Every disk was sawn into strips of 2.5 cm width. From the strips, specimens were prepared for firewood. The strips were oven-dried prior to analysis. The samples were further comminated with a wood machine except for density to obtain wood particles with a diameter of 1-2 mm, smaller and larger particles were discarded.

Combustibility Potentials of Fuelwood Species

The Fuel Value Index was calculated based on the energy characteristics viz., calorific value, specific gravity, lignin content and moisture content (Puri *et al.*, 1994). Heating value was calculated by using this Gouthal formula (Jacobsen *et al.*, 2014).

159

Data collection points within Ikwuano, Abia State

Area	Community/Accessions	GPS Location
Oboro	Umugbalu	$5^0 27300'$N, $7^0 33.521'$E
Ibere	Itunta	5°26'56.9"N 7°38'22.9"E
Oloko	Nchara	5°19'00.6"N 7°32'45.9"E
Ariam	Ekpiri	$5^0 08.650'$N, $7^0 20.386'$E

Wood Sample names and their biological names

Scientific name	Family	Common Name	Local Name
Dialium guineense	Fabaceae	Aba, Awin, Tsamiyar	Ukwa
Pterocarpus species	Fabaceae	Rosewood	Icheku
Theobroma cacao	Malvaceae	Koko, Kacao, chocolate	Cocoa
Dacryodes edulis	Burseraceae	Elumi, Nsafu, Butterfruit	Ube
Morinda coreia	Rubiaceae	-	Umemmiri
Milicia excelsa	Moraceae	Iroko	Ojii
Bridelia micrantha	Phyllanthaceae	-	Mkpe
Anthonotha macrophylla	Fabaceae	-	Ububa1
A. crassifolia	Fabaceae	-	Ububa2
Caloncoba welwitschii	Flacourtiaceae	-	Obia
Cnestis ferrugina	Connaraceae	-	Oron

Data Analysis

Data collected from the laboratory analysis was subjected to analysis of variance test (ANOVA), means were separated using Duncan Multiple Range Test (DMRT). Data was presented in tables and figures. All statistical tests were carried out using IBM SPSS Statistics Version 26.

RESULTS

Proximate Constituent of Different Fuelwood Species in the Study Area

The results of the proximate constituent of different wood species in Ikwuano LGA is presented in table 1. All chemical constituent showed significant differences ($p<0.05$) between the various wood species in Ikwuano LGA. From the result, Ash ranges from 2.69 % for Mkpe to 3.43 % for Icheku. Ash values across the sampled wood species showed a significant difference ($p<0.05$). Volatile Matter ranges from 83.35 for Cocoa to 87.18 for Ojii. Effect of difference in volatile Matter of wood varied significantly ($p<0.5$). Fixed Carbon ranges from 15.57 for Ojii to 19.46 for Cocoa. Fixed carbon values across the sampled wood species showed a significant difference ($p<0.05$). Liguin ranges from 21.39 for Obia to 30.10 for Ojii. Liguin values across the sampled wood species showed a significant difference ($p<0.05$). Cal.Valine ranges from 8.81(MJ/kg) for Nkwa to 13.19 (Mi/kg) for Cocoa. Cal.Valine values across the sampled wood species showed a significant difference ($p<0.05$).

Table 1: Variation in proximate constituent of wood species in Ikwuano LGA

Parameters	WOOD SPECIES										
	Ube	Ume-mmiri	Cocoa	Ububa1	Mkpe	Nkwa	Ububa2	Obia	Icheku	Ubube	Ojii
Ash (%)	2.95 ± 0.01^d	2.88 ± 0.00^e	2.81 ± 0.02^f	3.15 ± 0.01^b	2.69 ± 0.04^h	2.93 ± 0.07^{de}	3.08 ± 0.03^c	3.20 ± 0.03^b	3.43 ± 0.01^a	2.81 ± 0.00^f	2.74 ± 0.03^{gh}
Volatile Matter	83.59 ± 0.67^d	85.33 ± 0.15^c	83.35 ± 0.24^d	85.99 ± 0.04^b	87.04 ± 0.11^a	85.25 ± 0.11^c	86.13 ± 0.02^b	85.10 ± 0.06^c	85.10 ± 0.23^c	86.49 ± 0.04^b	87.18 ± 0.05^a
Fixed Carbon	19.36 ± 0.69^a	17.55 ± 0.15^d	19.46 ± 0.22^a	17.16 ± 0.03^{de}	15.66 ± 0.15^g	17.68 ± 0.18^{cd}	16.96 ± 0.01^e	18.10 ± 0.03^{bc}	18.33 ± 0.24^b	16.33 ± 0.04^f	15.57 ± 0.08^g
Lignin	26.96 ± 0.25^d	22.05 ± 0.13^{fgh}	22.75 ± 0.43^f	21.91 ± 0.81^{gh}	24.70 ± 0.48^e	27.29 ± 0.10^d	29.04 ± 0.11^b	21.39 ± 0.04^h	22.37 ± 0.01^{fg}	28.14 ± 0.03^c	30.10 ± 0.48^a
Cal. Value (MJ/kg)	9.21 ± 0.06^{fg}	9.54 ± 0.06^{ef}	13.19 ± 0.41^a	11.68 ± 0.40^b	10.23 ± 0.02^{cd}	8.81 ± 0.04^g	9.86 ± 0.01^d	10.44 ± 0.25^c	11.35 ± 0.05^b	11.25 ± 0.18^b	10.07 ± 0.29^{cd}

x ± SD = average mean generated from values across various wood species, ± standard deviation; post hoc = values with different superscripts (a > b > c > d) are significantly different (p<0.05), while values with same superscript are not significantly different (p>0.05). Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)

Combustibility of Tropical Fuelwood Species in Ikwuano Abia State

The results of the combustibility parameters of different wood species in Ikwuano LGA is presented in table 2 and figures 2 to 6. All combustibility parameters showed significant differences ($p<0.05$) between the various wood species in Ikwuano LGA. From the result, pyrolysis oil ranges from 24.70 % for Ojii to 33.08 % for Icheku. Pyrolysis oil values across the sampled wood species showed a significant difference ($p<0.05$). Basic Density (BD) ranges from 0.67 g/cm^3 for Mkpe to 2.75 g/cm^3 for Icheku. Basic Density values across the sampled wood species showed a significant difference ($p<0.05$). Viscosity tested 28°C ranges from 21.42 for Cocoa to 31.44 for Icheku. Viscosity values across the sampled wood species showed a significant difference ($p<0.05$). Moisture content (MC) ranges from 27.78% for Cocoa to 48.00% for Nkwa. Moisture content oil values across the sampled wood species showed a significant difference ($p<0.05$).

The firewood value index (FVI) of the wood samples is given in figure 2. From the result, Icheku, Ubube, and Cocoa had at above 20 % and were the best FVI recorded. The lowest FVI was recorded by Mkpe at less than 5 % FVI. The highest volatile ignitability (VI) was recorded by cocoa wood sample at 6.00 MJ/kg, the lowest was recorded by Ube at 2.00 mg/kg. All combustibility index (CI) of wood samples was above 40 MJ/kg. The highest fuel ratio (FR) of wood samples was cocoa and Ube at 0.25 mg/kg. The highest heat combustion ability, was recorded by Ojii at 13300 Kcal/kg, followed by Mkpe at 13192 Kcal/kg.

Table 2: Variation in combustibility of wood species in Ikwuano LGA

Parameters	WOOD SPECIES										
	Ube	Ume-mmiri	Cocoa	Ububa1	Mkpe	Nkwa	Ububa2	Obia	Icheku	Ubube	Ojii
Pyrolysis (oil) (%) Yield (%)	32.25 ± 0.55^b	30.92 ± 0.18^c	26.05 ± 0.18^f	28.40 ± 0.06^e	26.04 ± 0.11^f	31.40 ± 0.02^c	29.46 ± 0.00^d	31.30 ± 0.11^c	33.08 ± 0.06^a	25.38 ± 0.06^g	24.70 ± 0.59^h
BD g/cm³	1.98 ± 0.08^{bc}	0.86 ± 0.03^e	1.88 ± 0.04^c	1.37 ± 0.01^d	0.67 ± 0.08^e	2.08 ± 0.05^{bc}	1.37 ± 0.44^d	1.87 ± 0.01^c	2.75 ± 0.01^a	2.28 ± 0.05^b	0.81 ± 0.02^e
Viscosity tested @28°C (Cantipoise) cp	26.15 ± 0.04^e	29.10 ± 0.02^b	21.42 ± 0.00^h	25.51 ± 0.04^f	28.31 ± 0.00^c	31.29 ± 0.06^a	26.49 ± 0.09^e	29.14 ± 0.04^b	31.44 ± 0.03^a	27.77 ± 0.49^d	22.15 ± 0.01^g
MC (%)	46.19 ± 0.29^{ab}	44.64 ± 0.25^{bc}	27.78 ± 1.90^g	34.77 ± 1.85^f	41.46 ± 0.11^{de}	48.00 ± 0.17^a	43.15 ± 0.05^{cd}	40.48 ± 1.16^e	36.28 ± 0.23^f	36.76 ± 0.82^f	42.20 ± 1.33^{de}

x ± SD = average mean generated from values across various wood species, ± standard deviation; post hoc = values with different superscripts (a > b > c > d) are significantly different (p<0.05), while values with same superscript are not significantly different (p>0.05). Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)
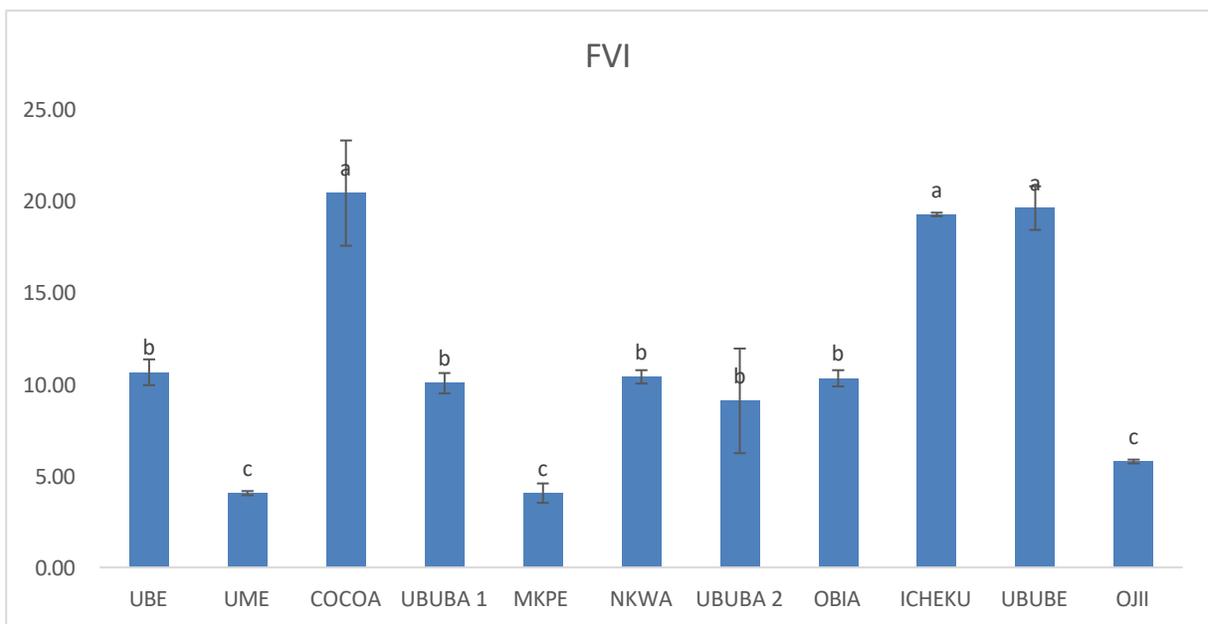
Fig. 2: Firewood value index of wood species

Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)
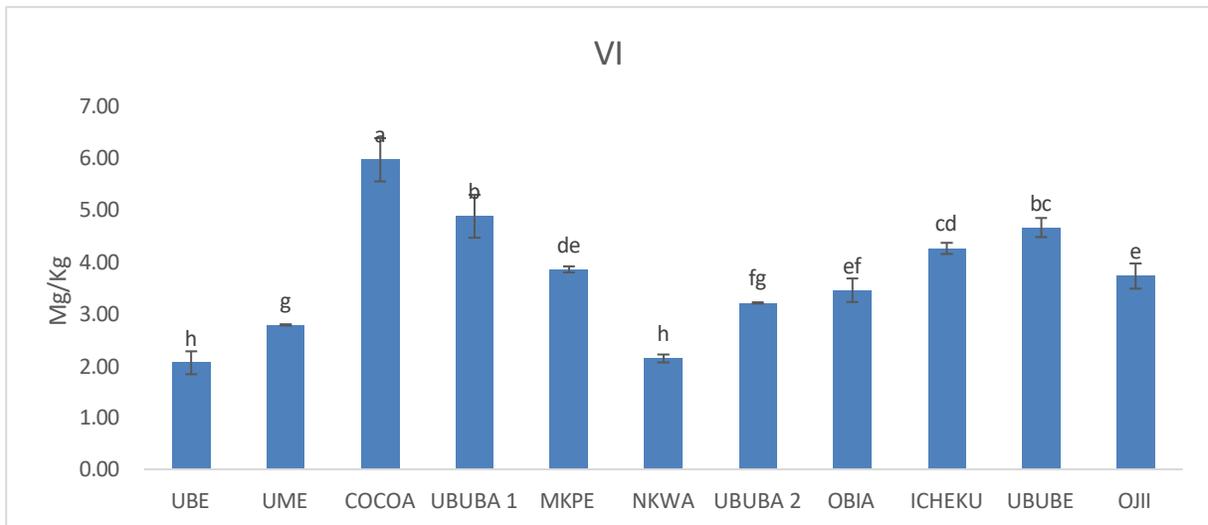

Fig. 3: Volatile ignitability (VI) of firewood species
Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)
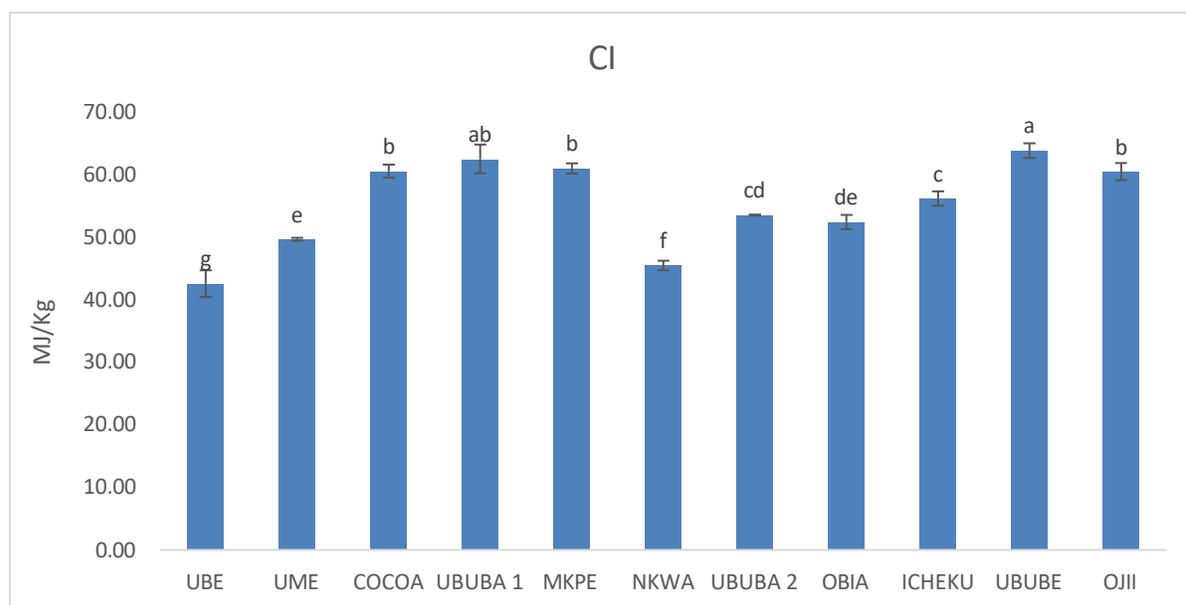
Fig. 4: Firewood combustibility index (CI) of wood species
Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)
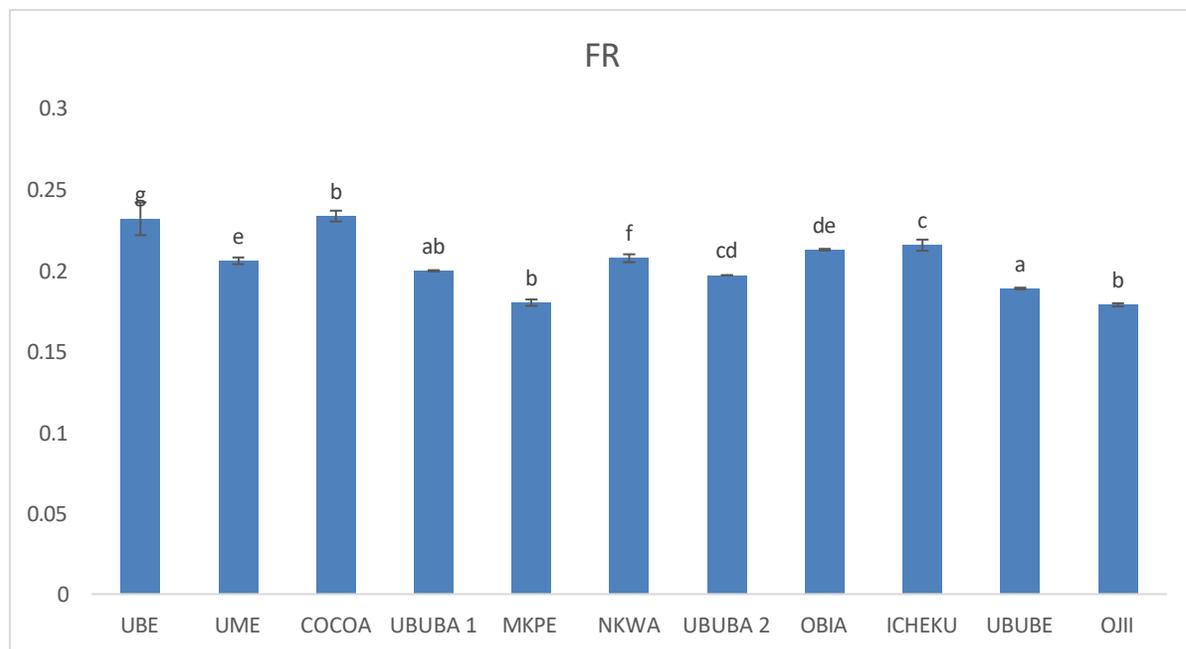

Fig. 5: Fuel ratio (FR) of wood species
Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)
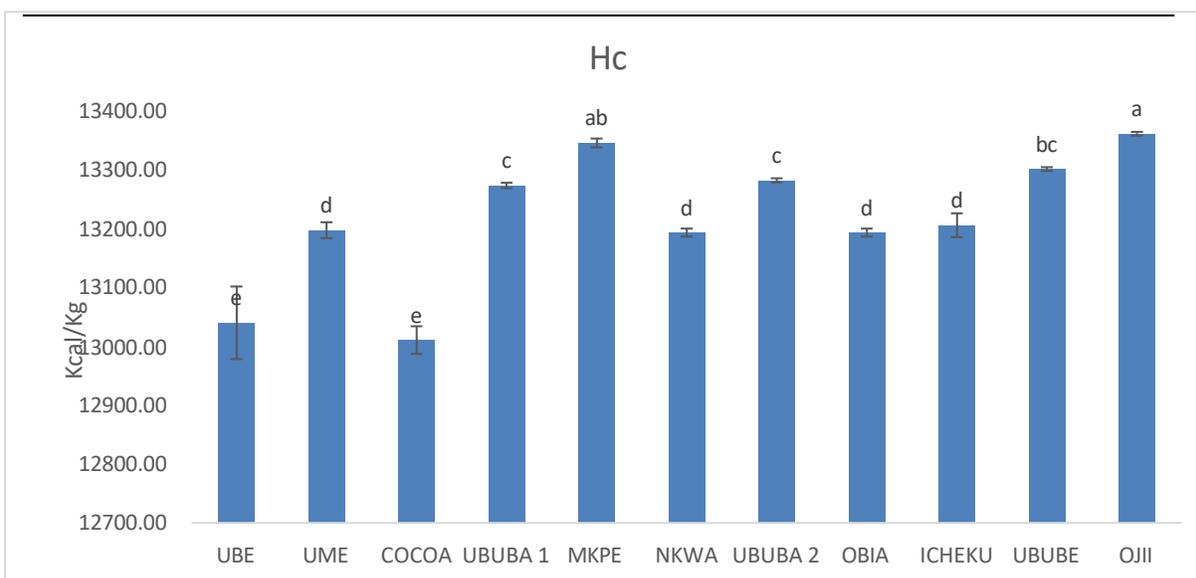
Fig. 6: Specific heat of combustion (HC) of wood species
Ukwa (*D. guineense*), Icheku (*Pterocarpus specie*), Cocoa (*T. Cacao*), Ube (*D. Edulis*), Umummiri (*M. coreia*), Ojii (*Milicia excelsa*), Ububa1 (*A. macrophylla*), Ububa2 (*A. crassifolia*), Obia (*C. welwitschii*), Oron (*C. ferrugina*)

DISCUSSION

Fuel wood remain the commonest in Nigeria partly due to its accessibility, affordability, convenience, tradition, and vegetation distribution as other sources are either uncommon, modern, costly, sophisticated, or required high levels of education and technology to explore, exploit, refine, distribute, store, utilized and maintained (Ibeto *et al*., 2016). This study was carried out to assess the ultimate elements, chemical, combustibility of wood species and the utilization of the wood species. Several researchers in Nigeria have performed several experiments on fuel combustion using rice husk, corn cob, and groundnut shell (Garba *et al*., 2017); Coconut shell (Ibeto *et al*., 2016); and some Nigerian wood species (Akinrinola, 2014).

The moisture levels of the fuelwood samples were largely below 50 %, cocoa fuelwood was observed to have lesser moisture than other samples. The moisture

levels of wood species in this current study were lower than those earlier reported by Othman *et al*. (2019). The Ube, Ume-mmiri and Nkwa were the fuelwood with the highest moisture concentrations. The ash production levels were in the range of 2.81 to 3.43 %. The Icheku fuelwood were observed to produce more ash when compared to the other sampled fuelwoods. The highest volatile matter concentrations were observed in the Ojii and Mkpe fuelwood. The fixed carbon was higher in cocoa and Ube fuelwood. The Fixed carbon reported in this study were similar to those earlier reported by Kpalo *et al*. (2021). Onukak *et al*. (2017) reported fixed carbon values of above 90% in tannery solid waste briquettes, which can be attributed to the high percentage fixed carbon values found in the original materials used to produce the briquettes. Fixed carbon content of wood can be as high as over 90% according to Onukak *et al*. (2017), or as low as <5% as reported in

briquettes produced from oil palm residues by Onochie *et al*. (2017). An appropriate percentage of fixed carbon is not strictly specified by any standard. This is because it is primarily dependent on the values of volatile matter and ash content. During combustion, fixed carbon serves as the main source of heat and the values obtained in this study can sufficiently enhance wood combustion.

Lignin concentration in all the fuelwood was high at a range of 22.05 to 30.10. this confirms that all the fuelwood samples are good for combustion. Kpalo *et al*. (2021) reported that the highest caloric value was seen in the cocoa fuel wood. calorific value of briquettes are two combined factors that control the time it takes for water to boil. The result from this study agrees with this assertion, judging by the calorific values of the wood samples. Similarly to this study, Adegoke *et al*. (2014) had earlier reported percentage ash content, fixed carbon and volatile matter ranged from 2.61 to 2.75%, 10.23 to 12.07% and 85.48 to 87.55% for *Gmelina arborea, Terminalia superba* and *Triplochitin scleroxylon*, respectively. The obtained values are lower than the average value range of 18 - 21 MJ/kg reported in (Steenari and Karlfeldt, 2010), Also lesser than the minimum requirement (>14.5 MJ/kg) recommended by (Akinrinola, 2014). Pyrolysis (oil) yield highest in Ube fuelwood. The least oil production capacity was seen in the Ojii, Cocoa and Mkpe fuelwood. The Nkwa and Icheku fuel wood has the highest basic density and viscosity. Adegoke *et al*. (2014) reported that the highest oil yield (45.70%) at 500°C followed by *T. superba* at 550°C (42.67%) while *G. arborea* had the lowest oil yield (33.03%) at 450°C. Except for in *G. arborea* the oil yield in this study were lower than those of Adegoke *et al*. (2014). However, Basic density levels were higher than those earlier reported by Adegoke *et al*. (2014).

Icheku, Ubube and Cocoa showed good firewood value index, and volatile ignitability, in comparison with another sampled fuelwood. All the fuelwood samples were above 40 MJ/kg combustibility. Also, given the high fuel ratio, fuelwoods sampled in this study are great sources of combustion. The least heat of combustion was seen in cocoa fuelwood. However, heating value reported in this study were lower than those of 32792.75±35.12 Kj/kg, 32691.56±35.12 Kj/kg, and 32794.15±35.17 Kj/kg for *G. arborea T. superba* and *T. scleroxylon* reported by Adegoke *et al*. (2014). For the combustibility index, Ohm *et al*. (2015) recommended a value range of 14-23 MJ/kg. The whole biomass studied agrees with the recommended value. Meanwhile, it was recommended that the volatile ignitability should have a specific calorific value of at least 14 MJ/kg (Garba *et al*., 2017).

CONCLUSION

This study screened fuelwood species in Ikwuano for proximate, and combustibility potentials and wood usage among for selected communities in Ikwuano, LGA, Abia State. The proximate data revealed that ash was relatively low across the sampled fuelwoods. However, Icheku, Obia and Ububa 2 were higher in ash levels. The calorific values of the hybrid fuelwood samples in this study are adequate to sustain combustion and produce heat enough to cook, potentially providing an energy source. The fixed carbon although statistically varied

significantly (p<0.05) were within same levels. The volatile matter was above 80 % in all the samples. This study investigated the combustion property and pyrolysis experiment, all the wood species showed significant ability to produce oil. However, Ube fuelwood was the best in terms of oil production (pyrolysis). The moisture levels in the wood were observed to be higher in fuel wood with high oil yield. Icheku, Ubube and Cocoa showed good firewood value index, and volatile ignitability, in comparison with another sampled fuelwood. All the fuelwood samples were above 40 MJ/kg combustibility. Also, given the high fuel ratio, fuelwoods sampled in this study are great sources of combustion. Rural community dwellers could use this fuel as alternative because of its other fuel sources value even though it is not the only determinant of the choice of wood in preference to wood.

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