American-Eurasian Journal of Scientific Research 9 (2): 35-38, 2014
ISSN 1818-6785

DOI: 10.5829/idosi.aejsr.2014.9.2.83301

Ash Contents Assay of Fifty-Two Selected Nigerian Timbers

[1]I.P. Udeozo, [2]A.N. Eboatu, [2]R.U. Arinze and [1]U.P. Ikezu

[1]Department of Chemical Sciences, Tansian University Umunya, Anambra State, Nigeria
[2]Department of Pure and Industrial Chemistry,
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

Abstract: The effect of ash contents of fifty-two selected Nigerian timbers was analyzed. The results showed that *Bombax brevicuspe* had the highest ash contents of 3.4% while *Dichapetalum barteri* recorded the least ash contents of 0.28%. There are five sets of timbers with equal ash content values. They are, *Gmelina arborea* and *Cynometra vogelii* (0.66%); *Garcinia kola* and *Casspourea barteri* (0.72%); *Shanti* and *Lovoa trichilioides* (1.01%); *Rhizophora racemosa* and *Barteria fistulosa* (1.11%); *Albizia adianthifolia* and *Caloncoba glauca (1.41%). P. elliottii* with the least ODD (19.9 $x10^{-2}$ $g.cm^{-3}$) had the ash content of 3.22% while *E. ivorense* with the highest ODD (108.7 $x10^{-2}$ $g.cm^{-3}$) recorded the ash content of 0.28%. The results also showed that timbers with very low ODD had high ash contents and those with high ODD values recorded low ash contents.

Key words: Ash contents · Oven dry density · Residual powder and Nigerian timbers

INTRODUCTION

Wood ash is the residual powder left after the combustion of wood. The main producers of wood ash are wood industries and power plants. About 0.43 and 1.82 percent of the mass of burned wood results in ash [1]. The composition of wood ash is influenced by the type of wood that has been burned. Also the conditions of the combustion affect the composition and amount of the residual ash, thus higher temperature will reduce ash yield [2].

Wood ash contains calcium carbonate as its major component, representing 25% [3] or even 45% [2], less than 10% is potash, less than 1% phosphate, there are trace elements of iron, manganese, zinc, copper and some heavy metals. However these numbers vary as combustion temperature is an important variable in determining wood ash composition [3].

For a long time wood ash has been used in agricultural soil applications as it recycles nutrients back to the land. Wood ash has some value as a fertilizer, but does not contain nitrogen. Because of the presence of calcium carbonate it acts as a liming agent and will deacidify the soil increasing its P^H. Potassium hydroxide can be made from wood ash, which in turn can be used to make soap. It is also used to make century eggs [3].

The fire performance of heavy timber depends on the charring rate of the particular timber. If the timber is sufficiently thick, as in the case of a log wall construction, the progress of the pyrolysis and combustion is slowed by the growth of the char layer which shields the unburnt layer [4]. Charring rates in the order of 0.8min/min for light dry wood, 0.6min/min for medium density softwood and 0.4min/min for heavy moist wood have been cited in the literature [5]. The standard test conditions used in this work is ASTM E 119 [6]. Wood and charcoal can be used as a source of carbon-dioxide for internal combustion engines. The denser timbers are preferable to the less dense ones and those with small ash content are more suitable than those with high ash content [3] and [6].

MATERIALS AND METHODS

Sample Collection and Preparation: The Fifty- two (52) timber samples were collected from Anambra, Enugu, Ebonyi, Imo, Delta, Edo, Cross River, Akwa Ibom, Abia, Oyo, Lagos, Kano, Sokoto and Rivers State, Nigeria. The timber samples were obtained from the timber sheds at Nnewi, Awka, Enugu, Abakaliki and Benin. The States from where these timbers were collected were ascertained from timber dealers and confirmed by literature [7], [8].

Corresponding Authors: I.P. Udeozo, Department of Chemical Sciences, Tansian University Umunya, Anambra State, Nigeria.

Table.1 Names of the Selected Fifty-Two (52) Timbers Used For This Research

S.No	Botanical Names	Igbo Names	Yoruba Names	Hausa Names	Areas of Location in Nigeria
1.	Monodora tenuifolia	ehuru ofia	lakesin	gujiyadanmiya	Port Harcourt
2.	Pycnanthus angolensis	Akwa-mili	akomu	akujaadi	Calabar, Awka
3.	Moringa oleifera	okwe oyibo	ewe igbale	zogallagandi	Lagos, Ibadan
4.	Protea elliottii	okwo	dehinbolorun	halshena	Nsukka
5.	Caloncoba glauca	udalla-enwe	kakandika	alibida	Onitsha
6.	Barteria nigritiana	ukwoifia	oko	idonzakara	Nsukka, Enugu
7.	Bacteria fistulosa	oje	oko	kadanya	Awka
8.	Anogeissus leiocarpus	atara	ayin	marike	Onitsha, Awka
9.	Rhizophora racemosa	ngala	egba	loko	Calabar
10.	Allanblackia floribunda	egba	eku,eso roro	guthiferae eku	Calabar, Ikom
11.	Garcinia kola	adi	orogbo	namijin-goro	Onitsha, Nnewi
12.	Glyphae brevis	anyasu alo	atori	bolukonu kanana	Calabar
13.	Hildegaridia barteri	ufuku	eso, shishi	kariya	Okigwe
14.	Sterculia oblonga	ebenebe	oroforofo	kukuki	Ibadan
15.	Cola laurifolia	ufa	aworiwo	karanga	Onitsha, Calabar
16.	Bombax brevicuspe	akpudele	awori	kurya	Ikom
17.	Bridelia micrantha	ogaofia	ida odan	kirni	Calabar, Ikom
18.	Bridelia ferruginea	ola	ira odan	kirni and kizini	Onitsha, Awka
19.	Uapaca guineensis	Obia	abo-emido	wawan kurmi	Onitsha
20.	Antidesma venosum	okoloto	aroro	kirni	Onitsha, Udi
21.	Parinari robusta	ohaba-uji	idofun	kasha-kaaji	Onitsha
22.	Cynometra vogelii	ubeze	anumutaba	alibida	Onitsha, Abakali
23.	Amphimas pterocarpoids	awo	ogiya	waawan kurmii	Umuahia, Iko
24.	Lovoa trichiliodes	sida	akoko igbo	epo-ipa	Calabar
25.	Berlinia grandiflora	ububa	apodo	dokar rafi	Enugu
26.	Albizia adianthifolia	avu	anyimebona	gamba	Enugu, Nsukka
27.	Oncoba spinosa	akpoko	kakandika	kokochiko	Onitsha
28.	Dichapetalum barteri	ngbu ewu	ira	kirni	Onitsha, Agulu
29.	Afzelia bipindensis	aja	olutoko	rogon daji	Benin
30.	Afzelia bella	uzoaka	peanut	epa	Owerri, Orlu
31.	Erythropleum ivorense	inyi	erun	idon zakara	Ogoja, Ijebu
32.	Dichrostacys cinerea	amiogwu	kara	dundu	Onitsha
33.	Pentaclethra macrophylla	ugba	apara	kiriya	Onitsha
34.	Tetrapleura tetraptera	oshosho	aridan	dawo	Onitsha
35.	Stemonnocoleus micranthus	nre		waawan kurmi	Ukpor, Awka
36.	Piliostigma thonningii	okpoatu	abafe	kalgo	Kano,Oyo
37.	Hymenocardia acida	ikalaga	orupa	jan yaro	Awka, Enugu
38.	Afrormosia laxiflora	abua ocha	shedun	don zakara	Sokoto
39.	Phyllanthus discoideus	isinkpi	ashasha	baushe	Enugu, Ikom
40.	Gardenia imperialis	uli	oroto	karandafi	Jos
41.	Macaranga hurifolia	awarowa	ohaha		Awka
42.	Sacoglottis gabonensis	nche	atala	chediya	Rivers
43.	Cassipourea barteri	itobo	odu	daniya	Eket
44.	Combretodendron macrocarpum	anwushi	akasun		Udi, Owerri
45.	Lophira lanceolata	okopia	iponhon	namijin kadai	Udi
46.	Homalinum letestui	akpuruukwu	out,obo-ako		Ikom
47.	Cordial millenii	okwe	omo	waawan kurmii	Owerri
48.	Gmelina arborea	gmelina	igi Melina	kalankuwa	Ibadan
49.	Drypetes aframensis		tafia		Ibadan
50.	Khaya ivorensis	ono	oganwo	madachi	Calabaar
51.	Spathodea campanulata	imiewu	Oruru	delinya	Onitsha
52.			Shanty		

The timber dealers were able to give the Local or common names of the timbers while the botanical names were obtained with the aid of forest officers and the literature [7,8].

The samples were taken to the saw mill at Nnewi Timber Shed where each timber was cut into two different shapes and sizes. Also dust from each timber was realized. The timbers were cut into splints of dimensions 30x 1.5 x 0.5cm and cubes of dimensions 2.5cm x2.5cmx 2.5cm i.e. 15.625 cubic centimeters. The splints were dried in an oven at 105°C for 24 h before the experiments.

Determination of Ash Content: The ash content was obtained using the ASTM E 119 which is similar to ISO 834 [6]. Wood dusts from different timber samples were measured into a crucible. This was heated in a Reverberatory furnace with a capacity of 800-1000°C. The samples were ashed. The time taken for the ash to form and the weight of the formed ash were taken. The weight of the crucible (W_2) had been taken earlier.

The weight of the crucible with the ash (W_3) was taken. Then the percentage ash content was calculated thus:

$$\text{Ash content (\%)} = \frac{W_3 - W_2}{W_1} \times 100$$

RESULTS AND DISCUSSION

The residual powder left after the combustion of wood is known as wood ash. It is composed of calcium carbonate (its major component), potash, phosphates, trace of other elements and some heavy metals. The percentage of ash formed from burnt wood is between 0.43 and 1.82 percent. This depends on the type of wood and combustion temperature [1], [2] and [4].

Figure 1 depicts the graph of ash content of fifty-two Nigerian timbers. *Bombax brevicuspe* had the highest ash contents of 3.4% while *Dichapetalum barteri* recorded the least ash contents of 0.28%. There are five sets of timbers with equal ash content values. They are, *Gmelina arborea* and *Cynometra vogelii* (0.66%); *Garcinia kola* and *Casspourea barteri* (0.72%); *Shanti* and *Lovoa trichilioides* (1.01%); *Rhizophora racemosa* and *Barteria fistulosa* (1.11%); *Albizia adianthifolia* and *Caloncoba glauca (1.41%)*.

Figure 2 is the graph of ash content against ODD of the timbers. *P. elliottii* with the least ODD (19.9 x10^{-2} g.cm^{-3}) had the ash content of 3.22% while *E. ivorense* with the highest ODD (108.7 x10^{-2} g.cm^{-3}) recorded the ash content of 0.28%. Timbers with very low ODD possess high ash content and those with high ODD values posses low ash content. Though very few timbers have high ODD values and high ash content values.

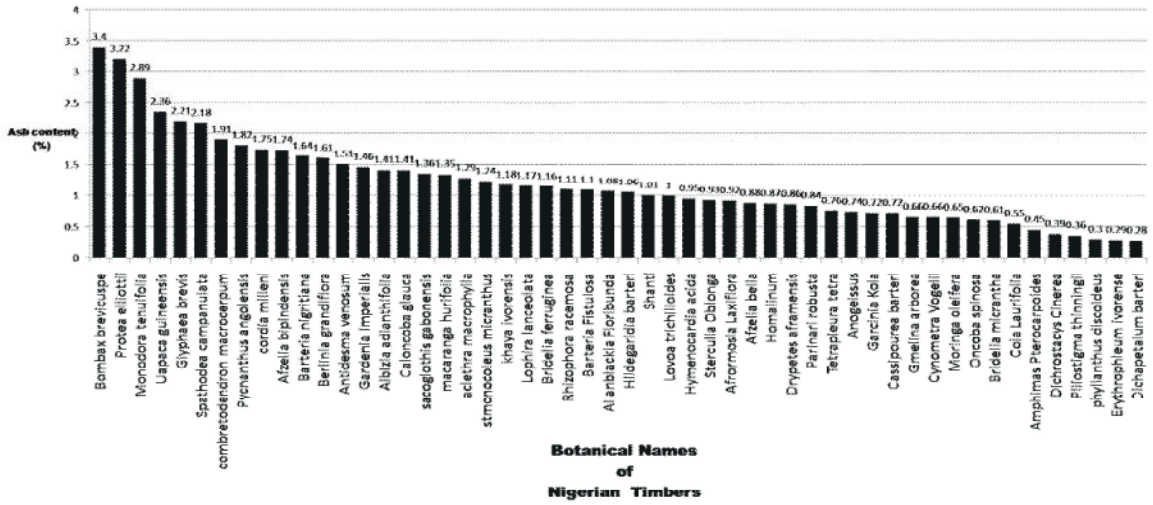

Fig. 1: Ash content of Fifty-Two Nigerian Timber

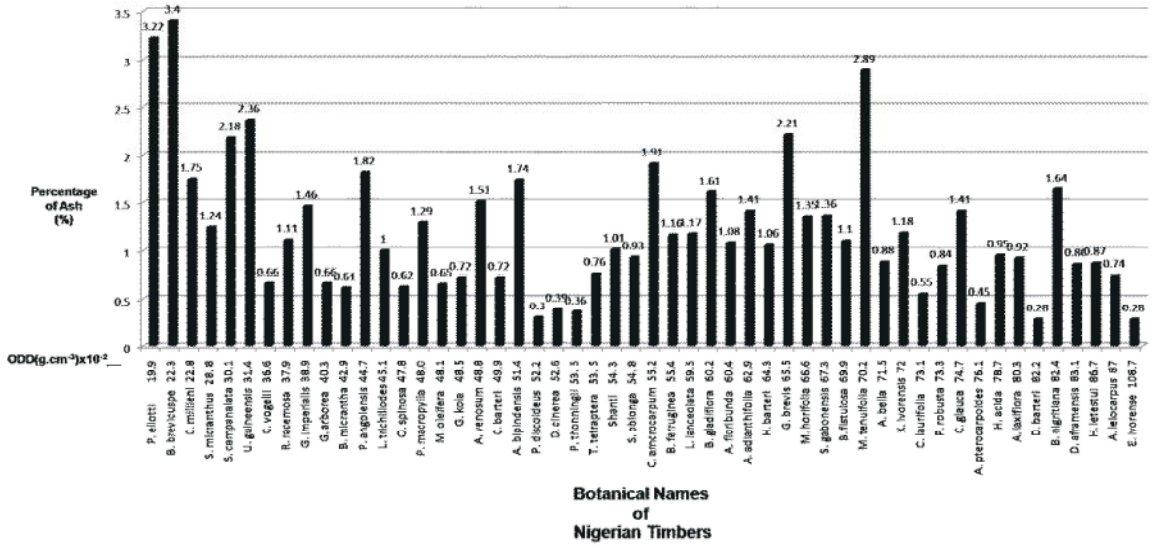

Fig. 2: Effect of ODD om Ash Content

This is in line with the assertion of [8] who stated that denser timbers possess small ash content and are more suitable than less dense ones (that form high ash content).

Also, sets of timbers with equal Ash content are found to have varied ODD. For instance, *Gmelina arborea* and *Cynometra vogelii* with ash contents of 0.66% possess ODD of 40.3 x10^{-2} g.cm^{-3} and 36.6 x10^{-2} g.cm^{-3} respectively; *Rhizopora racemosa* and *Barteria fistulosa* with ash content of 1.1% possess ODD of 37.9 x10^{-2}g.cm^{-3} and69.9 x10 g.cm^{-3} respectively. These anomalies could not be easily explained because of the fact that, the tree species vary physically and biochemically.

CONCLUSION

From the results above, one can conclude that, there is an inverse relationship between ash content and oven dry density of fifty two selected Nigerian timbers.

REFERENCES

1. Wood Encyclopaedia Britanica on line, 2011 Science and Technology http:/www.britamica.com/ EBchecked/topic/64725/woody.
2. Larson, P.R., 1994. The vascular cambium: development and structure Springer Verlag, Berlin.
3. Higuchi, T., 1997. Biochemistry and molecular Biology of wood. Springer-Verlag. New York.
4. Esau, K., 2007. Plant Anatomy, John Wiley and Sons Inc, New York, pp: 393.
5. Akindele, S.O. and V.M. LeMay, 2006. Development of tree volume equations for common timber species in the tropical rain forest area of Nigeria. *Journal of Forest Ecology and Management.* 226: 41-48.
6. Eboatu, A.N., B. Animashaun, S.T. Spiff and F.W. Abdulrahman, Journal of Thermal Analysis, 36(1990): 85-91.
7. Eboatu, A.N., A.N. Altine and F.W. Abdulraham, 1990. Studies onthermal characteristics of some common tropical timbers, Journal of Applied Polymer Science, 44: 239-242.
8. Desch, H.E and J.M. Dinwoodie, 1981. Timber, its structure,properties and utilization, Macmillan Press Ltd, London, 6th Edition, pp: 155-208.