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Study on the Fuel Wood Characteristics of Some Important Tree Species and Chemical Analysis of Wood in Maiduguri Metropolitan Council.

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ABSTRACT
This study was conducted to determine the physico-chemical and biochemical constituents of the wood of preferred tree species. The sample from the main trunk of eight (8) different species of trees, namely Acacia nilotica, Atospyres mesiliformis, Azadirachta indica, Adansonia digitata, Tamaridus indica, Balanites aegyptiaca, Mangitera indica, Psitum guajava were collected within Maiduguri metropolitan council was sampled using standard sampling equipment in the laboratory.The result indicated that Balanites aegytica has the highest FVI values of 7483.9% and Acacia nilotica has the lowest FVI value of 999.6% respectively.

Keyboards: - Fuel wood, Fuel value index (FVI), physico-chemical constituents, Biochemical constituent, Tree species.

I. INTRODUCTION

Fuel wood refers to various forms of wood that are used as fuel for cooking, heating, or drive to steam powered engines or turbines for electricity generation. Fuel wood is a fuel, such as firewood, charcoal, chips, sheets, pellets, and sawdust. Fuel wood comprises of firewood, charcoal and other wood derived fuels and account for Seventy per cent (70%) total energy use and Ninety per cent (90%) household energy used in Africa, since they are the predominant fuel in urban as well as rural settings (World resources, 2001). Fuel wood is the major tangible benefit to farmers through agroforestry system, their ranking in terms of quantitative values is equally important to evaluate the potential trees for fuel wood needs of the farmers. In industrialized countries, traditional biomass fuels, or particular wood fuels(fuel wood and charcoal), have long been replaced by more efficient and convenient sources of fuel even nowadays in many developing regions, especially sub-Saharan Africa, due to the poor affordability and accessibility of alternative sources, over 80 percent households are still heavily reliant on traditional fuels, primarily fuel wood, charcoal, dung and crop residues, to meet their energy needs (IEA 2014), mostly for cooking and heating. As a critical factor, widespread poverty in many rural areas of developing countries, contributes to the continued dependency on biomass energy sources and persistence of traditional and inefficient ways to use them (Mekonnen 2012).

Fuel wood collected from forests, either by lopping branches, fallen wood or cutting down of dry and diseased trees, is the most common source of domestic energy in the rural areas (Sedai et al 2014). The contribution of fuel wood to the total energy consumed varies from place to place and is mainly determined by the level of development and availability (Kumar et. al., 2011). Biomass broadly falls into four types based on primary source which are wood and agricultural products, municipal solid waste, landfill gas and biogas, and alcohol fuels and so on. Biomass has high input but variable moisture content and is made up of carbon, oxygen, nitrogen, sulphur and inorganic elements (Muhammad, 2016). The contribution of fuel wood to the total energy consumed varies from place to place and is mainly determined by the level of development and availability (Kumar et al., 2011). In Nigeria the utilization of fuel wood contributes greatly to desert encroachment and consequently has an implication with regards to climate change (World resources, 2001). Fuel wood shortage is being felt at the national and international levels, numerous tree species need to be evaluated for their potentials to overcome this shortage (Geyer et al., 2008), use of woody biomass for obtaining heat energy has increased dramatically over the last few decades as reported by (Bilandgila et al., 2012).

II. MATERIALS AND METHOD

Study Area

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This research would be conducted in Maiduguri the Borno State capital located at the North eastern part of Nigeria on latitude 11040'N and 11044'N and longitude 13005'E and 13O14'E. It covers a total area of 543km2 which makes it the largest city in the north eastern region of Nigeria (Daura, 2002). Borno State is the north eastern state of Nigeria with an area of 69,435,59km; it has a physical setting which arises from an amalgam of factors relating to location, geology, climate as well as the intensity of resources exploitation in the area. The state shares international boundaries with neighbouring countries such as Niger Republic, Chad and Cameroun and within Nigeria it shares boundaries with states like Adamawa, Yobe and Gombe (Phillips, 2011). It has a population of 4,151,193(Nigerian population commission (NPC, 2006).

Sample Procedure

The wood samples from the main trunk of Eight (8) different species of trees namely Azadiractaindica, Balanitesaegyptiaca, Acacia nilotica, Mangiferaindica, Atospyresmespiliformis, Adansoniadigitata, Psitumguajava, Tamaridusindica, within Maiduguri metropolitan council will be sampled using standard sampling equipment. All trees species collected will be brought to the laboratory for determination of their various properties, such as Determination of Calorific Value (Bomb Calorimeter), determination of ash content, determination of moisture content, determination of density content, determination of lignin content, determination of cellulose content, determination of volatile meter, and the fuel value index (FVI) and also to determine the chemical analysis of the wood.Fuel value index will be computed as follow: Purohit and Nautiyal (1987).

$$\textbf{FVI} = \frac{\textbf{Calorific value} \times \textbf{Basic Density}}{\textbf{Ash content (\%)} \times \textbf{Moisture content (\%)}}$$

III. RESULTS AND DISCUSSION

Table1: Biochemical constituents of wood of the preferred tree species

Name of the plant Species	Cellulose %	Lignin (%)	Volatile matter
Acacia nilotica	42.25	32.28	13.11
Atospyrus mespiliformis	37.49	29.01	18.03
Azadirachta indica	40.21	31.21	11.09
Adansonia digitata	39.11	33.10	12.24
Tamaridus Indica	32.51	24.19	11.31
Balanites aegyptica	49.01	30.22	12.11
Mangifera Indica	36.21	35.21	12.70
Psitum guajava	38.92	25.15	10.73

Table 2:Physico-chemical constituentsof wood of the preferred tree species

Name of plant species	Wood Moisture content	Wood Basic Density	Ash content	Calorific value	Fuel Value Index (FVI)
Acacia nilotica	41.81	0.63	2.82	18.52	999.6

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Atospyres mespiliformis	34.31	0.83	1.67	39.38	5704.6
Azadirachta indica	43.33	0.71	1.71	29.01	2889.7
Adansonia digitata	51.02	0.52	6.03	19.30	3262.2
Tamaridus indica	42.73	0.84	1.62	18.37	2238.2
Balanites aegyptica	45.65	0.27	2.01	25.43	7483.9
Mangifera indica	42.32	0.79	1.81	35.21	3631.4
Psitum guajava	41.37	0.74	1.32	26.12	3549.4

IV. DISCUSSION

Biochemical analysis (Cellulose, lignin and volatile matter)

The results for biochemical constituents of the wood species are indicated in Table1, that the table values obtained for in the authors study are in the close agreement with the literature value (Sedai et, al : 2016) and it varied in the range of 35.21% (Mangifera indica) has a highest value and 24.18% (Tamaridus indica) has a lowest value. The cellulose content also varied between. 49.01% (Balanites aegyptica) and 32.51% (Tamaridus indica). While the volatile matter was reveal to vary between 10.73% (Psitum guajava) and 18.03% (Atospyrus mesipiliformis).

Physico-chemical analysis (moisture content, basic density, Ash content, calorific value)

The moisture content for the studied wood species is indicated in Table2. The moisture content of the tree species was revealing to beAdansonia digitata has the highest moisture content of 51.02% and Atospyres mespiliformis has the lowest moisture of 34.31%. Also the density of the tree species was observed to Tamaridus indica has the highest value of 0.84% and Balanites aegyptica has the lowest value of 0.27% meanwhile ash content was observed to vary between 2.82% (Acacia nilotica) and 1.32% Psitum guajava.

Lastly calorific value is the thermochemical properly of fuel and is defined as the amount of heat available in a fuel (mj/kg). It has the (Atospyrus mespiliformis) has the highest value of 39.38% and (Tamaridus indica) has the lowest value of 18.37%.The different parameter carried out in the past have a significant effect on the calorific value of wood species, which in turn influences the FVI of the wood species, the physico-chemical and Biochemical constituent of the fuel wood are all important. Which determined the amount of heat generated by a fuel wood? The fuel value index (FVI) has indicated that Balanites aegytica has the highest value of 7483.9% and Acacia nilotica has the lowest value of 999.6%, respectively.

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