Environmental Effects of Sawmilling Industry and Relevance of Wood Wastes in Nigeria

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Abstract
There are numerous sawmills nowadays that process wood. A few of which are medium to large-sized, while a good number of them are small-sized. All these sawmill generate wood wastes during their primary processing. There are also some wood industries in the country but only few of them efficiently utilize their wood wastes. The wastes generated by these mills which could be inform of slabs, off-cut and sawdust among others cause environmental pollution and health hazard during burning. In order to avert this problem, there should be an efficient utilization of the wood wastes by converting them to usable products like particleboard, asbestos, cement/paper/sawdust composite board and briquettes. To this effect, a number of sawmills should form wood complexes so that the benefit accruing from the same volume of wood can be optimized.
Keyword: Sawmill, Wood waste, sawdust, Environment pollution, particleboard.

Introduction

Mechanical wood industry is an industry where wood as a major raw material is processed with the use of machines to ease conversion e.g. Premier Timber Industry (Nig)'Ltd, Piedment, Wan wood, Integrated sawmills and paper mills among others. In the process of converting these timbers into marketable sizes, a wide variety of dust and noxious gaseous emissions are discharged into the atmosphere while when wastes and residues are burnt in our mills they courses an undesirable and damaging impact on the biosphere and the people. Hence there is need for efficient wood waste utilization and ensure a cleaning environment.

In the wood industry, the major input is wood which is the major raw material the world have ever known and may vary from species to species. Basically when hardwood species are used, we obtain sawn timber as the product which can be used by the cabinet

makers and carpenters for roofing houses. Examples of these hardwood species are: *Khayaivorensis, Meliciaexcelsa, Afzeliaafricana* among others. The combination of *Triplochitonscleroxylon, Terminaliasuperba and cordiamillenii* when rotary peeled will produce plywood from veneer. *Pinuscarabea.Gmelinaarborea* and some other soft wood species can be used to feed paper mill to produce paper from pulp.

A review of the efficiency of utilization of wood in Nigeria today showed that about 45% of log input into the sawmill end up as mill residues. This can significantly be reduced if the wood working mills are integrated such that wastes in one section would be used as raw materials for some other section. An integrated mill may have an efficiency of up to 76.4% (Thorpe 1983).

The future of wood based industries depends on the status of the forest cover, demand for wood products and growth in population. Human population growth is a crucial factor in the consideration of future industrial raw materials demand. Youngquist & Hamilton (1999) reported that world population doubled between 1850 and 1950 and projected two times increase between 1950 and 2050. This projection in population growth shows that there would be more pressure on the forest for the supply of goods and services.

Over the years, much exploration of the forest has been done in order to meet the increasing demand of the teeming population. This has resulted in serious depletion of the resource base to the extent that some favoured timber species have become scarce while others have become extinct in certain ecological zones. Geomatics (1998) reported that the land area occupied by high forest in Nigeria decreased by 11,254 km^2 between 1976 and 1995 while the land area occupied by Savannah decreased by 90,593 km" during the same period.

These changes in forest cover have not only drastically reduced the wood resources base of the country but have negatively affected the operations of wood-based industry. The number of sawmills in the country reduced from 1470 in 1990 to 1349 in 1997 while the number of functional plywood mills declined from eight to four within the same period as shown in Table 1 Fuwape (1998). Some of the wood-based companies that have been adversely affected by shortage of required quality of wood raw material include African Timber and Plywood Company Limited Sapele, Calabar Veneer and Plywood Limited Calabar. Nigeria Romania Wood Industry Limited, Ondo and Epe Ply Mill, Epe.

In spite of the dwindling forest resources and reduction in the productivity of Nigerian wood based industries, the wood requirement projection by General Wood and Veneer Consultants (1994) showed that the demand for wood and wood products is expected to increase from 140 million cubic metres in the year 2000 to 172 million cubic metres in the year 2010.

The problem of declining availability of timber raw materials may be solved by adopting technology that aids forest productivity and efficient utilization of forest resources on sustainable basis. It is expected that the use of genetically improved indigenous species and fast growing trees in plantation establishment would enhance forest productivity. Efficient log conversion and processing of wood residues will improve timber recovery and reduce the demand for round log. The adoption of non-destructive evaluation' technology in timber grading is expected to allow wider range of wood species to be substituted for in structural applications (Youngquist & Hamilton, 2000).

Table 1 - The Major Wood-Based Mills In Nigeria (1974-1997)

TYPES OF MILL	YEARS					
	1974	1981	1984	1990	1993	1997
Sawmill	350	1076	1300	1470	1470	1349
Plywood Mill	4	6	6	8	7	4
Particle Board	0	2	2	2	4	4
Match Splint	3	6	6	6	6	7
Pulp Paper Mill	1	1	3	3	3	(NF)

Source: Fuwape, 1998.

Problems associated with wood wastes

In the absence of using sawdust and other wood waste for useful products, the smoke coming out from the burning sawdust reduces the quality of air in our environment. In Wanwood for example, wood waste are stored in an open space behind the factory unburnt. When air blows over it, it removes some of the dust into the atmosphere therefore polluting the air. In other words, it causes environmental pollution.

It also costs much money to remove the waste in order to avert environmental pollution. For example, Wanwood Nig. Industry spends 1.3 million naira monthly for the removal of wastes generated by the industry. The same amount of money paid for the state wastes 'Management Board could beused to convert the wastes to more usable products, which will fetch the company, more income (Datob Consultant, 2002).

During combustion of the wastes, there could be formation of carbon monoxide that could cause health hazard when inhaled. When the wastes are converted to more usable products, it offers some benefits to mankind by generating more income for the industry through the sales of the additional products using the same quantity of raw materials. With the use of wood residues as source of raw material for other products, employment opportunity will be made available to people as additional machines will be installed which will require manpower for operation.

Biogas that is produced from wood residues, animal manure and human wastes through wood gas fraction plant can be used for electricity generation as an alternative source of energy for the industry and locality.

Volumes of wastes generated by the mills

Out of the total percentage of logs in our saw-milling industries, the actual volume of sawn-timber is approximately in the range of 40% to 50% of the tree log volumes (Alviar, 1983). The remaining 60% to 50% becomes residues or wastes materials in form of slabs, edgings, sawdust and shavings (Alviar, 1983). The amount of slabs and sawdust generated by sawmills were found to be about 36.6% and 8.1% respectively in a study area which covered Ibadan, Benin City and Lagos (Alviar 1983). Badejo (1980), in a study of 75 small-sized sawmills in Lagos, estimated the yearly volume of residue generated in form of slabs and sawdust to be about 13300m^3 and 31000m^3 respectively. It must be noted that there is

considerable quantity of bark generated. This was estimated to be about 6.3% of the log input (Alviar, 1983).

Sawmills, plymills and veneer mills are industries that uses round wood (logs) as their raw materials. The wastes recorded in these mills are usually large. Particleboard and fibreboard factories are capable of using the residues recovered from the round wood using mills. Using the result of other workers, the wastes recorded could yield 6.0 - 11.2m^3 of particleboard. (Istrate, 1983)

Badejo & Giwa (1985) estimated a total of 1,719, 700rn^2 waste wood volume for all the sawmill in Nigeria and suggested that wood waste be used for particleboard and wood cementboard and also for energy gas generation in wood gasification plants for industrial and other uses.

Nature of wastes from mills

It is not all the wastes from the mills that are economically viable. Basically, the wastes that are generally usable from sawmill and ply mills are:

i. **Off cut:** These are wastes resulting from log ends while cutting them to flitches. Flitches are round wood with relatively short lengths. These can serve as raw materials for producing particleboard and fibre board.

ii. **Slabs:** These are wastes of solid wood resulting from sawing. In most cases, they contain some bark and they result more from wood sap. They can serve as raw materials for particleboard and fibreboards.

iii. **Coarse Sawdust:** These constitute about 80% of sawmill wastes (Fuwape, 1986). Also, they are particles of wood and can be used for producing particleboard and cement/sawdust/wastepaper bonded board (Osuntuyi, 2002).

Wastes from ply mills include

(i) Veneer Sheets: These are veneer not suitable for plywood as a result of one defect or the other. Some only suffer from sub-dimension which render them unsuitable for recomposition by slicing into standard size of the plywood that is to be produced. Some may also be as a result of turning of the veneer beyond jointing along the grain in case of face veneer and back veneer. They are used for the production of fibre board and particleboard.

(ii) Coarse Residues: These are centre core of the log. They are purely heart wood. If they are not affected by a defect called heart rot, they have better physical and mechanical properties than the other parts of the log from where they result. They are good for sawing into planks as well as clipping for particleboard production.

(iii) Timber: These are the tolerance added to the product at the beginning and then removed during the final sizing. They are of the same composition as the plywood. They are good for both particle and fibre boards. Hence, if the wastes are properly managed or utilized, a number of benefits can be derived such as partitioning, cladding, car case construction and for the construction of table top.

Products Obtainable from Wood Wastes

Utilization of wood residues for particleboard

Particleboard provides an effective means of optimizing wood resources of our forest through utilization of wood residue. The possibility of being able to use the whole tree would mean that less forest will be harvested to supply the same quantity of wood product needs.

Although, a few wood processing industries have understood the need for using their wood residue to produce particleboard yet a good number of them have not come to the realization of that fact. Among those industries who have realized the desirability of using those wood residues or wastes are; Piedmont plywood, Nigerian Romania Wood Industry and African Timber Plywood Limited, There are considerably large number of sawmill in the country which process the bulk of the wood resources from our forest and they are widely scattered and largely unintegrated.

From 1981 to date, there are a number of new generation sawmills. Establishment of particleboard plants located in the center of these mills could be a way of finding efficient use for wood wastes generated by the mills but the small-sized and widely scattered nature of the mills would make this a difficult thing to do. Nevertheless, how to integrate the scattered mills with particleboard plants centrally located sincerely needs serious thought.

Utilization of Wood Wastes as Briquettes

Briquettes could be made from sawdust, shavings from logs, wood residues or dust charcoal. Whatever material is chosen is compressed together with or without a binder in block sizes of 30cm x 30cm x 15cm in cylinder size of diameter 20cm x L30 cm. The more common binder in use includes; resins, coal tar, pitch petroleum refuse or waste sulphite liquor, but they may also be found without any binder.

Kishimoto & Sugura (1981) described the use of starch as a binder .or producing charcoal briquettes from dust.

Utilization of Wood Wastes for Direct Combustion in Boiler

Wood wastes like slabs, offcut and negets at the flowing could be as material for generating heat for the boiler by direct combustion. The use of wood as boiler fuel is based on the fact that wood generates a lot of heat energy upon combustion. The first Product Research Laboratory, Canada and the United State of America Forest produce laboratory determined average heating values for hardwood at 19.77 MJ/Kg and 20.00 MJ/Kg respectively.

The heating value of a wood species depends on the chemical composition of the wood substances. There are other factors that influence the available heat from the combustion of a piece of wood which include; the quantity of moisture in the wood, the moisture formed in the burning of hydrogen, the amount of air admitted into the combustion chamber and radiation losses etc. These details should be taking into account when designing the boilers. The heat generated at the boiler is used to serve the dryers, supply steam for dyeing and heat for press in not press.

Utilization of Wood Wastes for Energy Gas Generation in Wood Gasification Plant

From biomes, it is possible to produce two types of gas fuels. The first type of gas fuel is biogas while the second type is producer gas.

Biogas: This is produced by the action of microbe on animal manure, human wastes and some plant materials which could be wood wastes in absence of oxygen. It contains 60% methane and may be used in biogas powered set for generating electricity. The electricity obtained from this can be an alternative source of power for the industries and locality.

Producer gas: This gas is generated by the partial oxidation of biomass in a thermal gasifier with limited intake of air. Producer gas has an energy content of about 5.9 MJ/m^3, Bio energy Systems of Report (1983), and is used to fuel producer gas-powered generating sets.

Conclusion and Recommendation

In order to reduce environmental pollution caused by the mechanical wood industry through the combustion of their wastes and the irrational harvesting of logs from our forest which could lead to depletion of trees and consequently causing ecological disaster, there should be efficient and effective utilization of the by-products, resulting from the primary processing. This can be by; discouraging the widespread of small-sized saw mills while emphasis should be placed on a few medium to large-sized ones.

Wood industries that would form product manufacturing complexes to make it possible to allocate wood raw materials to the manufacturing process where it can be most efficiently utilized must be highly integrated.

There must be a direct and promotion, research activities towards funding better feasible uses for wood wastes and production of particleboards, briquettes and biogas with the objective of utilization of wood residues.

References

Alviar, G.O. (1983). Report on forest industries in Nigeria F.O. NIR/008 working document No. 124 Federal Dept. of Forestry Lagos Pp I.

Badejo, S.O.O. (1980). Cummulative and quantitative survey of generated wood residues in Lagos State Sawmills. A paper prepared for the 12th Biennial conference of the Science Association of Nigeria.

Badejo, S.O.O.& Giwa, S.A. (1985).Volume Assessment and Economic Importance of Wood Waste Utilization in Nigeria, Technical Report No. 50 Forestry Research Institute of Nigeria, Ibadan.

BSR (Bioenergy Systems of Report 1982). June (1983). Bioenergy Power Generation.

Datob Consultant (2002). Report on Environmental Auditing in Respect of Wanwood Nigeria Limited, Akure Road, Oba-Ile.

Fuwape. J.A. (1986). Checking Deforestation through improved wood conversion technology. Proceeding of Annual Conferences of Forestry Association of Nigeria, pp. 479-485.

Fuwape, J.A. (1993b). Charcoal and fuel value of Agro-forestry tree crops. Agro-forestry systems. 22. 175-179.

Fuwape, J.A. (1998). Development in Wood-based Industries inNigeria. Foresea Miyazaki 2: 575-585.

Fuwape, J.A. (2000). Wood Utilization: From cradle to grave. Inaugural lecture series 25, delivered at the Federal University of Technology, Akure.

GWVC (General Wood and Veneer Consultants) (1994): Review of the Wood-Based Sector in Nigeria. Presented to Forest Management Evaluation Unit. Abuja.560 pp.

Istrate, V. (1983). TechnologiaProduselorAgolomerate din lemn. EdituraTehnica. Bucuresti.

Kishimoto, S. & Suguwa, G. (1981). Wood Fuels in Japan. Japanese Charcoal, Sawdust Briquettes (ogacite) and other wood fuels. Research Institute, Japan.

Osei, Y.A. (1990). New School Chemistry. Senior Secondary Science Series.

Thorpe, E. (1983). Forest Industries, Nigerian Forest Sub-Sector Review, Report submitted to Forestry Project Monitoring Evaluation Unit. Federal Department of Forestry, Ibadan.104 pp.

Youngquist, J.A. & Hamilton, T.E. (1999). Wood Products - A Call for Reflection and Innovation Forest Products Journal 49 (11/12) : 18 - 27.

Youngquist, J.A. & Hamilton, T.E. (2000). A look at the world's timber resources and processing facilities in proceedings, Forests and Society, XXIIUFRO World Congress 2000 Kuala Lumpur Malaysia. Pp. 183-189.