International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 19 No. 1 Nov. 2015, pp. 15-23

http://www.ijisr.issr-journals.org/

The management and disposal of small scale sawmills residues at the Sokoban and Ahwia wood markets in Kumasi – Ghana

Bernard Effah[1], Kwaku Antwi[2], Ernest Boampong[1], Jack Nti Asamoah[3], and Osei Asibey[1]

[1]Department of Interior Architecture and Furniture Production, Kumasi Polytechnic, Kumasi-Ashanti, Ghana

[2]PhD Student, Department of Construction and Wood Technology Education, University of Education-Winneba, Kumasi Campus, Kumasi-Ashanti, Ghana

[3]Department of Civil Engineering, Kumasi Polytechnic, Kumasi-Ashanti, Ghana

ABSTRACT: This research assessed how small scale sawmills residues at Sokoban and Ahwia wood markets are managed and disposed off and suggested appropriate measures for dealing with the situation of waste disposal at these industrial estates. The study was conducted at two local timber markets in Kumasi and its environs in the Ashanti region of Ghana. The study was a descriptive social survey design which sought to portray an accurate profile of persons, events and situations. To harness the needed information, a triangulation method comprising of questionnaire, interview and observation/photography methods were employed in gathering data. For primary data collection, systematic random sampling method was used to select a realised sample of 208 respondents from an infinite population comprising of wood processors, carpenters and timber sellers from the areas under survey. The study showed sawing and planing as the highest waste generation sources. Sawdust was the highest waste generated by the artisans while majority were also collecting their waste by manual clearing. The artisans have also resorted to open burning as the means of disposing their waste. There was general assertion that state authorities were not doing enough to manage waste at the surveyed sites. A significant positive correlation between methods of collecting waste and methods of disposal practiced were identified. Ideally, the easiest and most cost-effective way of managing any waste is not to generate it in the first place. Reassessing daily practices and overall product design of the artisans may significantly reduce the amount of wood waste they discard.

KEYWORDS: Sawdust, waste management, timber market, open-burning, pollution.

1 INTRODUCTION

Ghana is a country with a warm equatorial climate endowed with vast natural resources of all kinds for the social and economical aspirations of its citizens. Ghana's timber industry contributes 4.0% of GDP and happens to be the third largest foreign exchange earner for the country [1]. Presently, Ghana is confronted with a number of serious environmental challenges among which are land degradation, coastal erosion, pollution of rivers and lagoons, deforestation, desertification and waste management [2]. The issue of solid waste management has become a major problem at global, regional and local levels and one of the difficult issues for local authorities in urban centers in Ghana [3]. As a nation, the net effect of waste borders on concerns such as health, sustainable development, climate change and environmental protection. Industrial activities and urbanization for a developing country like Ghana has gradually led to the deterioration and contamination of the natural environment in modern years.

As the demand for wood and its products increase, the volume of wastes being generated is enormous and cannot be increased [4]. One of the utmost environmental problems is how to dispose properly, the waste being generated daily by the ever increasing activities of small scale sawmills. The timber industry is challenged with low recovery rate leading to waste

Corresponding Author: Bernard Effah

and the loss of almost 70% of the raw material [1]. In the UK, the cost of waste account for 5% of turnover in the furniture manufacturing sector and the reduction, reuse and recycling initiatives generated savings to the tune of 10% profits [5]. The UNEP is also optimistic of the considerable climate benefits that could be achieved through improved management of wastes [6]. According to UNEP [6], the informal waste sector contribute significantly to resource recovery and green house gases savings in cities of developing nations, however, this contribution is normally ignored.

Saw mills by nature generate a lot of wastes like sawdust, wood offcutts, wood rejects, chips, wood shavings, and bark [4]. The problems posed by these wastes are many: they degrade the urban environment, reduce its aesthetic value, produce offensive odours during the rains and pollute the air with smoke when the wastes are burnt uncontrollably. They also constitute health hazards in themselves if they are not timely disposed as they become breeding places for worms and insects [4], [7]. Accumulating hazardous waste on site can pose a threat to human health and the environment [8]. A waste is any solid, liquid, or contained gaseous material that is discarded by being disposed of, burned or incinerated, or recycled [8]. Waste generation by itself impacts negatively on the climate, nonetheless the treatment and disposal of waste can have both positive and negative impacts on the climate [6]. The inability of the small and medium sawmill sector to perform effectively has resulted in high wood residue production, which is inversely related to the output of lumber yield. Wood residues include a large spectrum of wood products from primary and secondary processing such as bark, slabs, sawdust, chips, planer shavings, sander dust, end trims, used pallets, and construction residues [9]. Nielsen et al. [10] identified three main wood waste streams; harvesting residues, wood processing residues and wood waste going into landfills. They further argued that the main stakeholders for wood waste utilization are the wood processing industry, the waste management sector and the energy sector.

There are various products that can be derived from wood wastes and yet still wood residues are often spilled on open spaces, sometimes occupying lands for development. Likewise, they also constitute bad working environment for those working in the area, due to accumulation of wastes over a period of time most especially during raining season. Wood residue leachate contains high concentrations of natural organic material which can mobilize metals such as Iron from soils [11]. Threats to forests due to adverse effect of climate change could be effectively tackled by increasing the use of wood residues [12].

The situations of waste disposal in Ghana are similar to those of her fellow developing countries within the tropical climates [13]. In Ghana, majority of landfills are open dumps, even though these are strongly discouraged in the national sanitation policy. Ghana's first sanitary landfill facilities were commissioned in Accra, Kumasi, Sekondi-Takoradi and Tamale between 2003 and 2004 [13]. In Ghana, the issue of collection, management and disposal of solid waste continues to feature prominently across the country. It is clear that the inability of state authorities to systematically manage waste and especially wood residues is presenting challenges such as the contamination of water bodies leading to the spread of water-borne diseases, health hazards from the stench emanating from uncollected and decaying garbage, air contamination, garbage-chocked drains and gutters, irresponsible disposal of refuse at our industrial areas and others. Recently, the problem of sanitation has assumed increased prominence as a political issue especially in urban areas leading to the introduction of a by-monthly national sanitation day. Saw dust is a major air pollutant as well as a source of smoke from burnt wood waste [14]. This research assessed how small scale sawmills residues at the Sokoban and Ahwia wood markets are managed and disposed off and suggested appropriate measures for dealing with the situation of waste disposal at these two industrial estates.

2 MATERIALS AND METHODS

2.1 STUDY AREAS

The study was conducted at two local timber markets in Kumasi and its environs in the Ashanti region of Ghana. Kumasi is located in the transitional forest zone and is about 270km north of Accra. It is between latitude 6.35^{o}-6.40^{o} and longitude 1.30^{o}-1.35^{o}, and covers a total land area of $254km^{2}$ and has an elevation ranging between 250-300 meters above sea level. Precisely, the Sokoban wood market located at Sokoban on the outskirt of the Kumasi Metropolis and the Ahwiaa timber market in the Kwabre District. The Sokoban Wood Village is a conglomerated wood industry made up of micro, small, and medium-scale firms which produces all kinds of wood products ranging from household furniture to office furniture [14]. The Ahwiaa timber market on the other hand is at the heart of Ahwiaa, a small town located on the main Kumasi-Mampong highway, about 14 kilometers north of Kumasi in the Kwabre District of Ashanti region. These two timber markets are very important centers for wood processing and two of the main wood markets in the country. The markets are run by small scale saw millers, lumber brokers and artisans who obtained their wood stocks from sawmills and chainsaw operators. The main

activities are sales of lumber and secondary and tertiary processing of lumber. The timber markets are communities that house lumber brokers, carpenters and other woodworkers, with economic activities ranging from the sale of food, wood and wood products as well as accessories for wood work and financial institutions.

2.2 RESEARCH DESIGN AND DATA COLLECTION

The study was a descriptive social survey design which sought to portray an accurate profile of persons, events and situations as well as describe the distribution of phenomena in a sample and population [15], [16]. The survey strategy is usually associated with the deductive research approach and mostly used to answer who, what, where, how much and how many questions [17]. Surveys also provide an effective way of describing the more objective characteristics of a population [16]. To harness the needed information, a triangulation method comprising of questionnaire, interview and observation/photography methods were employed in gathering data from the respondents. For primary data collection, systematic random sampling method was used to select a realised sample of 208 respondents from an infinite population comprising of wood processors, carpenters and timber sellers from the areas under survey. This was due to the impossibility of covering the whole population and also to give credibility to the study.

Closed ended form of questionnaire of 30 items was designed to elicit information from the respondents. The questionnaire was categorized into six main theme headings. Section A contained issues on waste generation sources. Section B elicited information on the type of wood waste that was generated by the respondents. Section C contained information on the means of collecting the waste generated. Whiles section D asked of issues on the method of waste disposal practiced by the artisans. Sections E and F enquired about the wood waste management system practiced and the involvement of state authorities in waste management respectively at the timber markets. All the section required the respondents to indicate Yes or No to the statements provided under each item. Personal interviews, participant observation and desktop study were conducted to buttress the information generated from the questionnaire. In all forty people were interviewed. Photography was used to capture important scenes of the study and to strengthen evidence of observed events. All the methods focused on the sources of waste generation, types of waste generated, means of collecting the waste, methods of waste disposal, waste management systems, authorities' involvement and the way forward. The data obtained from all the sources were evaluated using correlation test, content analysis, descriptive statistics and graphs.

3 RESULTS AND DISCUSSION

From the analysis, the survey indicated categories of the respondents to be 60 (28.8%) wood processors, 102 (49%) carpenters and 46 (22.1%) timber sellers.

3.1 WASTE GENERATION SOURCES

Wood waste residue is generated from a variety of sources and production processes, including sawing, planing, mortising, lathe turning, and sanding. Result from the study (Figure 1) shows sawing and planing as the highest waste generation sources. Majority of the respondents also had mortising as their source of waste generation. Sanding and lathe turning were the sources of waste generation for some minority of respondents. Ideally, the best way to deal effectively with waste is to reduce it at the source and after that find potential use for the waste generated.

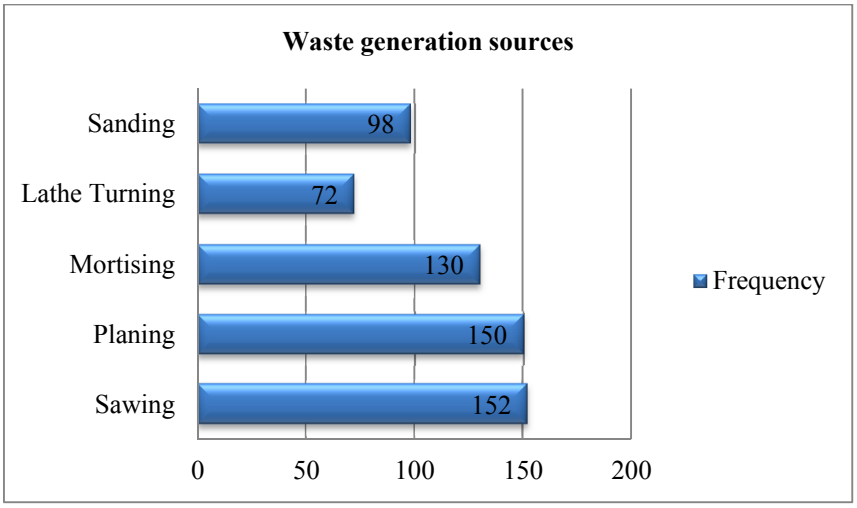

Figure 1: Waste generation sources

3.2 TYPE OF WOOD WASTE GENERATED

Figure 2 shows the type of wood waste that is generated by the respondents. Sawdust was the highest waste generated. This was closely followed by shavings as the second type of waste generated. With frequencies of 114 and 110, offcutts and chips were the next forms of waste generated respectively. Sanding powder (74) was indicated by some respondents also as waste type they generate. Bark received the least response (38) as being the last source of waste generated according to the findings of the study.

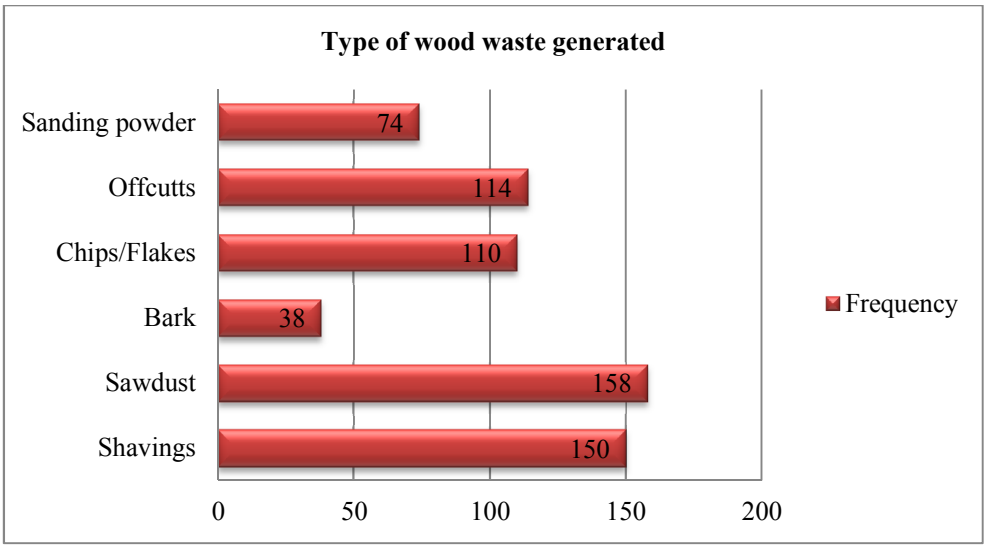

Figure 2: Type of wood waste generated

3.3 WAYS OF COLLECTING WASTE GENERATED

To ascertain the means by which the respondents collect their waste, six ways of waste collecting were put before them to indicate and the result is depicted in Figure 3. Only two respondents were collecting waste by air extraction. Majority (158) collected their waste by manual clearing. Bagging and packaging with sacks is also the collection means by 100 respondents. Ninety-two respondents also use wheel barrow to carry the waste. Carriage by truck and tractor are also practice by 86 and 54 respondents respectively.

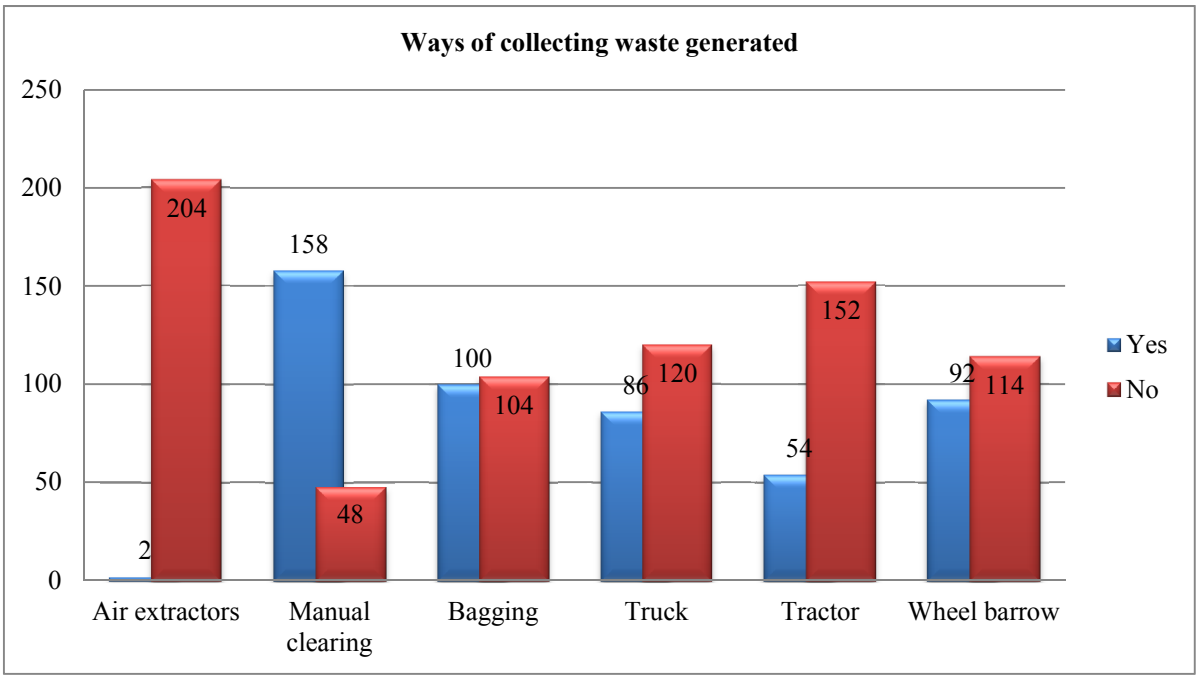

Figure 3: Ways of collecting waste generated

3.4 METHOD OF WASTE DISPOSAL PRACTICE/AVAILABLE

Figure 4 is the results on the method of waste disposal practiced at the study sites. The collection by households was confirmed by 88 respondents. Collection by poultry farmers accounted for 102 respondents. The highest response (152) was practicing open burning. Open pits and open dumping also scored 88 and 98 respectively. There are some wood waste management practices aimed at reducing the impacts of sawmill wood wastes at the study sites. Some artisans have tried to reduce the volume of wood waste by on-site storage or disposals. Possible solid waste management practices includes collection, recycling, solid waste disposal on land, treatments as well as incineration and open burning of waste. Lack of transportation to transport the waste from the site to designated safe places has led to majority resulting in opening burning just at the sites.

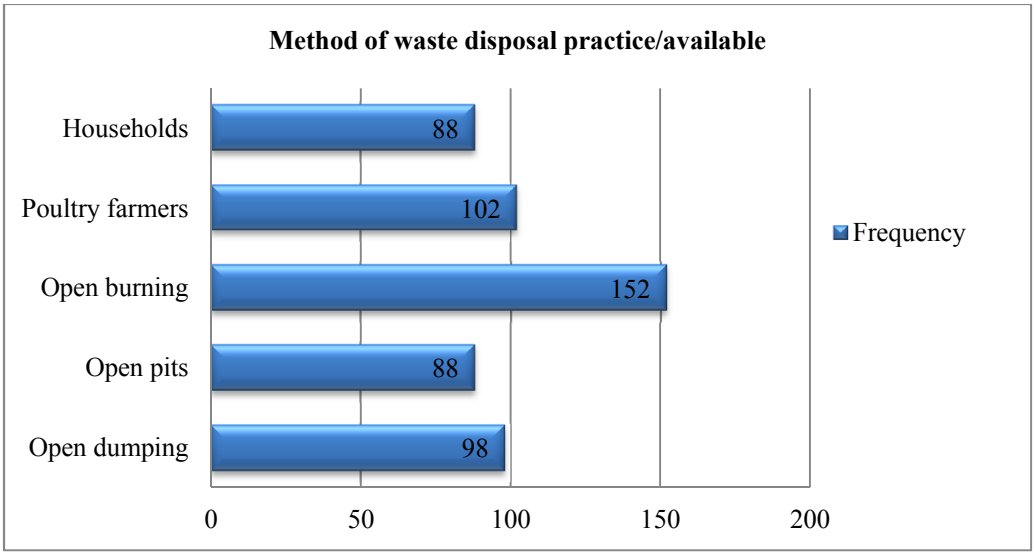

Figure 4: Method of waste disposal practice/available

3.5 WOOD WASTE MANAGEMENT SYSTEM PRACTICE/AVAILABLE

There is various waste management system that could be put in place to management waste effectively. However, in a developing country like Ghana, very few are practiced. The results on the waste management system available and practiced are shown in Figure 5. Landfill site is available and practiced by majority (110). Incinerator/combustion, treatment plant and recycling are utilized by some few minorities of 24, 24 and 28 respectively. Bedding is practiced by almost half of the respondents. Ideally, the easiest and most cost-effective way of managing any waste is not to generate it in the first place. But once the waste is generated, one can decrease the amount of waste produced by developing a few "good housekeeping" habits that could save businesses money and prevent accidents and waste as prescribed by EPA [8]. When waste has been minimized at the source, consideration must be given to its potential reuse. This means reprocessing the waste to manufacture composite boards, animal bedding, mulches, charcoal and generation of energy.

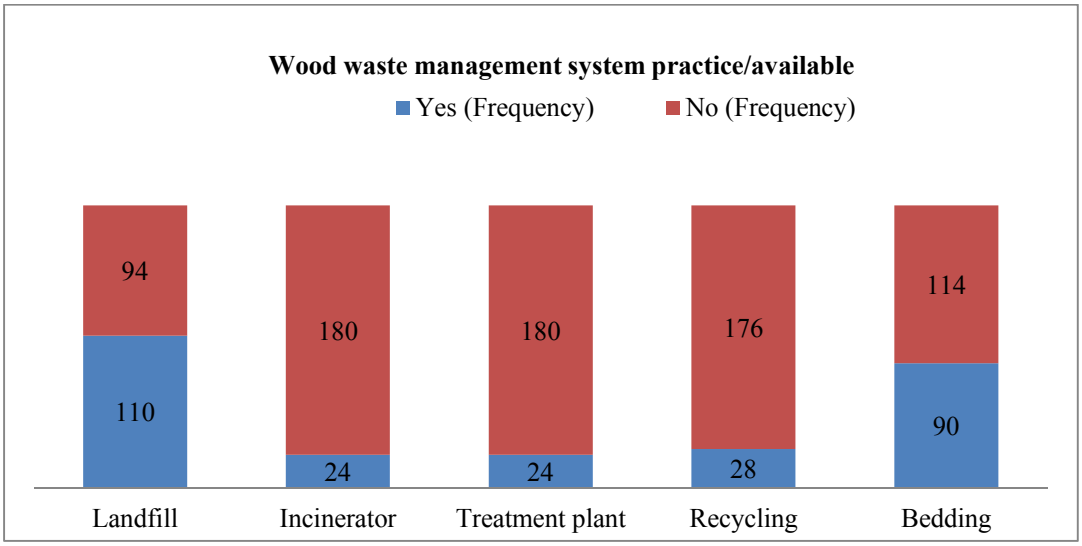

Figure 5: Wood waste management system practice/available

3.6 INVOLVEMENT OF STATE AUTHORITIES IN WASTE MANAGEMENT

To know the efforts of state authorities in dealing with waste management at the study sites, three statements were posed to the respondents. Majority of the respondents (55.8%) are aware of some regulations relating to the disposal of the waste they create. Half of the respondents agreed on their awareness of the consequences of the waste generated at the timber markets, whiles the other half are not in the known of the consequences of the waste they generate. However, majority (64.4%) assert that state authorities are not doing enough to manage waste at the surveyed sites. Combination of these factors has made it difficult to breath because of the stench in the area and the large cloud of smoke in the areas. Table 1 shows the involvement of state authorities in managing waste at the study sites.

Table 1: Involvement of state authorities in waste management

Statement	Frequency (%) Yes	No
Are you much aware of the regulations relating to the disposal of waste in this industry?	116 (55.8)	88 (42.3)
Are you aware of the consequences of the waste generated by activities of this enclave?	104 (50)	98 (47.1)
Are the authorities doing well in managing waste at this enclave?	70 (33.7)	134 (64.4)

3.7 CORRELATION

Pearson correlation measures the extent to which variables vary in the same way. Correlation coefficients range from • 1.0 to +1.0 with 0 meaning no relationship between the variables, and 1.0 meaning a perfect relationship, one to the other. A positive correlation is one in which a higher score on one variable is related to a higher score on the other. A significant positive correlation between methods of collecting waste generated (manual, bagging, truck carriage, tractor carriage, barrow carriage) and methods of disposal practiced (open dumping, open pits, open burning, poultry farmers, households) were identified at p<0.01 level and p<0.05 level. Table 2 shows correlation between the between methods of collecting waste generated and methods of disposal practiced.

Table 2: Correlation between methods of collecting waste generated and methods of disposal practiced

	Open Dumping	Manual Clearing	Bagging by sacks	Truck Carriage	Tractor Carriage	W. Barrow Carriage	Open Pits	Open Burning	Poultry Farmers
Manual	0.387**								
Bagging	0.470**	0.451**							
Truck Carriage	0.613**	0.420**	0.593**						
Tractor Carriage	0.493**	0.276**	0.256**	0.570**					
W. Barrow Carriage	0.356**	0.357**	0.175*	0.190**	0.530**				
Open Pits	0.514**	0.383**	0.532**	0.543**	0.378**	0.211**			
Open Burning	0.435**	0.768**	0.394**	0.460**	0.305**	0.402**	0.381**		
Poultry Farmers	0.612**	0.454**	0.529**	0.658**	0.469**	0.321**	0.558**	0.414**	
Households	0.435**	0.383**	0.373**	0.383**	0.199**	0.330**	0.365**	0.381**	0.519**

**. Correlation is significant at the p<0.01 level (2-tailed).

*. Correlation is significant at the p<0.05 level (2-tailed).

Some scenes from Sokoban timber market:(a) mountain of sawdust in a shop (b) bagged sawdust (c) open burning site (d) open burning and dumping site

4 CONCLUSION

A large amount of wood waste is produced in our society by small scale sawmills especially in our timber markets. The issue of wood waste generation and disposal is a common problem in all the timber markets in the country, and unfortunately, this valuable natural resource often ends up taking up valuable landfill space or is burned illegally, negatively impacting the environment. This paper sought to create awareness on minimizing wood waste generation and the realities related to proper disposal of wood waste. It specifically assessed how small scale sawmills residues at the Sokoban and Ahwia wood markets are managed and disposed off and suggested appropriate measures for dealing with the situation of waste disposal at these two industrial estates.

Wood waste residue is generated from a variety of sources and production processes, including sawing, planing, mortising, lathe turning, and sanding. The study showed sawing and planing as the highest waste generation sources. Large piles of wood residue are commonly stored at wood processing facilities. Residues of sawmilling process such as bark, chips, sawdust, shavings and slabs were generated, however, sawdust was the highest waste generated by the artisans. Majority were also collecting their waste by manual clearing. The artisans have also resorted to open burning as the means of disposing their waste. Lack of transportation to transport the waste from the site to designated safe places has led to majority resulting in opening burning just at the sites. There was general assertion that state authorities were not doing enough to manage waste at the surveyed sites. Ideally, the easiest and most cost-effective way of managing any waste is not to generate it in the first place. But once the waste is generated, one can decrease the amount of waste produced by developing a few “good housekeeping” habits. Reassessing daily practices and overall product design of the artisans may significantly reduce the amount of wood waste they discard. A significant positive correlation between methods of collecting waste and methods of disposal practiced were identified. When waste has been minimized at the source, consideration must be given to its potential reuse. This means reprocessing the waste to manufacture composite boards, animal bedding, mulches, charcoal and generation of energy.

REFERENCES

[1] J. Sutton and B. Kpentey, *An Enterprise Map of Ghana*, International Growth Centre, London Publishing Partnership, London; United Kingdom, 2012.

[2] Government of Ghana (GoG), National Environmental Sanitation Strategy and Action Plan (NESSAP) 2010–2015, Ministry of Local Government and Rural Development, Environmental Health and Sanitation Directorate, 2010.

[3] E. Owusu-Sekyere, E. Harris and E. Bonyah, "Forecasting and Planning for Solid Waste Generation in the Kumasi Metropolitan Area of Ghana: An ARIMA Time Series Approach", *International Journal of Sciences,* (2) 69- 83, 2013.

[4] O. O. Dosunmu and A. B. Ajayi, "Problems and management of sawmill waste in Lagos". *Proceedings of International Symposium on Environmental Pollution Control and Waste Management, 7-10 January 2002, Tunis (EPCOWM'2002),* p.271-278, 2002.

[5] WRAP, *Wood waste recycling in furniture manufacturing - a good practice guide*, 2003. www.wrap.org.uk

[6] UNEP, *Waste and Climate Change: Global trends and strategy framework.* United Nations Environmental Programme; Division of Technology, Industry and Economics, International Environmental Technology Centre Osaka/Shiga, 2010.

[7] T. Akinbode and A. B. J. Olujimi, "Effects of Sawmill wastes in residential areas of Ogbese and Akure townships, Ondo State, Nigeria", *International Journal of Innovation and Scientific Research*; 9 (2), 399-409, 2014.

[8] EPA, *Managing your hazardous waste; A Guide for Small Businesses*, USA: EPA, 2001.

[9] P. Nzokou, J. Simons and A. Weatherspoon, "Wood Residue Processing and Utilization in Southeastern Michigan," *Arboriculture & Urban Forestry*, 37(1): 13–18, 2011.

[10] P. S. Nielsen *et al.*, "Utilisation of Wood Waste - Challenges for the sector," *14th Annual Lifeafterwaste Conference*, WasteMINZ, Rotorua 6-8 November, 2002.

[11] F. O. Arimoro, R. B. Ikomi and E. C. Osalor, "The Impact of Sawmill Wood Wastes on the Water Quality and Fish Communities of Benin River, Niger Delta Area, Nigeria," *World Journal of Zoology* 1 (2): 94-102, 2006.

[12] G. Daian and B. Ozarska, "Wood waste management practices and strategies to increase sustainability standards in the Australian wooden furniture manufacturing sector," *Journal of Cleaner Production*, (17) 1594-1602, 2009.

[13] A. Mensah and E. Larbi, Solid Waste Disposal in Ghana. *WELL FACTSHEET* - Regional Annex, 2005. http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/RSA%20Solid%20waste.htm

[14] K. D. Attuquayefio and A. R. Abdulai, *Environmental and Social Management Plan (ESMP): Construction of access roads with kerbs and drains at Sokoban wood village*, Kumasi Metropolitan Assembly, Ghana, 2013.

[15] C. Robson, *Real World Research* (2nd ed). Blackwell, Oxford, 2002.

[16] V. Jupp, *The Sage Dictionary of Social Research Methods*, SAGE Publications Ltd, London, 2006.

[17] M. Saunders, P. Lewis and A. Thornhill, *Research Methods for Business Students* (5th ed), Pearson Education Ltd., England, 2009.