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Socio-Economic Importance of Lithered Waste Disposal and Utilization: A Case Study of Adamawa State

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Abstract

Materials recovery from waste has been practiced for several centuries in different parts of the world. Whilst it provides a means of livelihood for many, and supplies cheap and environmental friendly raw materials to industries, it also represent an affordable means of waste disposal. The objective of this study was to asses solid waste recovery and utilization in Adamawa state, evaluate the problems and suggest some ways of improving it. The study also investigated waste generation rate and composition at household level within different income class. The result of the study shows that average generation rate in the study area is 0.52kg/head/day. Composition of waste varies with income group and social customs of the people among other things. The average composition of waste generated at household level shows that organic waste heats up with 1%. The major problems facing materials recovery in the study area include; lack of purchase point at the grass root level, inadequate capital, and low price, location of potential users and purity of the recovery items there is however adequate quantity of racy cables in the study area. The way forward must involve the combined effort of government

industries, private and informal sectors. Key words: waste, household, environment, recovery, management; recycling.

Keywords: *Socio-Economic, Importance, Lithered, Waste Disposal and Utilization.*

Introduction

In a broad sense, lithered wastes include all discarded solid material from municipal, industrial and agricultural activities. Although human or animal excreta often end up in the solid waste stream, generally the term lithered waste does not include such materials (Zurbrugg, 2003).

Human activities create waste and it is the way these waste are handled, stored, collected and disposed of, which can pose risk to the environment and to public health. Industry has become essential part of a modern society, and waste production is an inevitable outcome of the developmental activities. A material becomes waste when it is discarded without expecting to become compensated for its inherent value (Misra and Pandey, 2005).

More than 8 million tons of solid waste is produced daily in developing countries and over 95% of this disposed of in landfills, open dumps, drainage, riverbank and the sea or simply combusted on-site due to insufficient waste collection and final disposal system (Abubakar, 2006).

In Nigeria along, the annual generation of municipal solid waste (MSW) is 29.78 X 10^9 kg (Ojolo, etal, 2004). The main components of these are putriscible materials, papers, plastic, rubber, textiles and metals (USEPA, 2003 and Ojolo, 2004).

Waste is a significant and growing problem in many urban areas of the developing world. In Nigeria, for instance, most urban centres are experiencing an increased rate of environmental deterioration, with refuse dumped along the streets, behind homes and drainage channels. Therefore, the urban dwellers is very much in contact with the waste generated by him. Government has not been able to handle satisfactorily the problem of littered waste as the size and concentration of people in urban areas increase.

The improper management of waste represents a source of air, land and water pollution, and poses risks on

human health and the environment. Despite considerable expenses, the situation tend to further deteriorate due to rapid growth of cities and this trend is predicted to continue over the next few decades (Medina, 2002). An analysis of the composition, characteristics and quantities of wastes is essential as it provides the basic data on which the management system is planned, designed and operated. It also indicates the amount and types of material suitable for processing and recycling as well appropriate technology among others.

Waste management in developing countries has received less attention from policy makers and academics compared to that paid to other urban environmental problems such as air pollution and waste water treatment. Nevertheless, the improper handling and disposal of wastes constitute a serious problem.

It contributes to the high morbidity and mortality rates in main third world cities (Medina, 2002).

In general, the challenges in waste management of developing countries includes; inadequate service coverage and operational inefficiencies of services, limited utilization of recycling activities, inadequate landfill disposal and inadequate management of hazardous and health cane waste. Above all, there is little or no data on solid waste generation in general and waste recovery and utilization in particular in Adamawa state, Nigeria.

This study therefore attempts to assess waste recovery and utilization in Adamawa state and also make appropriate recommendations such that waste generation does not constitute a nuisance to the society as presently experienced.

REASONS FOR THE RESEARCH WORK

The reasons for the research work is to:-

i. Assess the level of waste recovery and utilization in Adamawa state.
ii. Assess the level of participation of government, private and informal sector in waste recovery and utilization in the study area.
iii. To evaluate the problems of waste recovery and utilization.
iv. To make appropriate recommendation on the possible way to improve waste recovery and utilization in Adamawa state. . **Waste Generation and composition**

Generation:

Waste generation, both domestic and industrial contribution to increase world-wide in tandem with growth in consumption. In developed countries, per capita waste generation increased nearly threefold over the last two decades, reaching a level five to six times higher than that in developing countries [Richard, 2002]. The study further revealed that with increases in population and living standards, waste generation in developing countries is also increasing rapidly, and may double in volume in the current decade more than 8million tons of waste in produced daily in developing countries [Abubakar 2006]. The global burden of municipal waste amounted to 1.3billion metric tons in 1990, or two-third of a kilogram of waste per person per day [Beede and Bloom, 1995].

Waste generation rates are a function of both population and prosperity, but data are having or questionable for many countries (Bogner et.al.2007). The same report however put waste generation rates as ranging from <0.1 tons/capital/year in high-income industries to >0.8 tons/capital/year in high-income industrialized countries. In a similar report, Richard (2002) put the range from 0.15 to 0.33 tons/person/year for developing countries and further reported that all the countries that have a GNP per capital less than US$400 produce under 0.25 tons/person/year. The quantity of waste generated is an indirect reflection of life style in a community as reported in Sangodoyin, (1991) study.

Composition;

Waste composition indicates the components of waste or volume. The component categories as listed by Richard(2002) usually include: compostable (including food, yard and wood waste) paper, plastic, metal, glass and others (includes ceramics, textile, leather, rubber, bones, inert, ashes, coconut husks, bulky wastes, house hold goods). The report further indicated that; MSW as delivered (wet basis) from Accra, Ibadan, Dakar, Abidjan, and Lusaka show putrescible organic content ranging from 35-80% (generally toward the higher end of this range:, plastic, glass and metals at less than 10% and paper with a percentage in the low teens.

To the extent that these figures are approximated, they indicate a waste stream of limited potential and commercial value for the recovery of metals, glass, plastic and paper. Though the per-capital generation rates of these materials are relatively low, they may be present in sufficient quantities in MSW streams of

densely populated cities to warrant labor-intensive recovery ventures. The high organic content suggest value as composting material. However, the viability of these schemes is likely to depend highly on end markets for their productions. The low calorific value make the waste stream unsuitable for energy recovery via incineration.

Direct analysis of waste provides important information about the composition of waste produced by various sources. The information is a useful tool for authorities in charge of the reduction and management of the waste stream (TRI, 2005).

The composition and characteristic of municipal waste vary throughout the world. Even in the same country, it changes from place to place as it depend on a number of factors such as social customs, standard of living, geographical location, climate etc. as such, no rational decisions on municipal solid waste system are possible until data of composition and quantity of waste are available.

WASTE REUSE, RECYCLING AND COMPOSTING RE-USE

In general, at the household level in low income per-urban areas, resource recovery begins with the reuse of plastic bags, bottles, paper, cardboard, and cans for domestic purpose, thereby extending their useful life. The rate of reuse in this instance is high, and these materials enter the waste stream only when they are no longer fit for domestic use (Richard, 2002).

According to a study by media (2002), reusing materials and products saves energy and water, reduces pollution, and lessens society's consumption of natural resources compared the use of single use products and materials.

The study further pointed out that the reuse of materials and products is regarded as more socially desirable than recycling the same material.

Re-use of organic waste materials, often contributing to more than 50% of the total waste amount, is still fairly limited but often has great recovery potential. It reduces cost of the disposal facilities, prolongs the sites life span, and also reduces the environmental impact of disposal sites as the organics are largely to blame for the polluting leachate and methane problems (Zurbrugg, 2003). The study also linked this as one of the reason why waste managers in many part of the world are now exploring ways to reduce the flow of biodegradable materials to landfills.

Recycling and composting

The practice of recycling waste is an ancient one. Metal implements where melted down and recast in prehistoric times (Abubakar, 2006). Today, it is teachnically feasible to recycle a large amount of materials, such as plastics, wood, metals, glass, textiles, paper, cardboard, rubber, ceramics and leather (Medina, 2002).

Besides technical feasibility and know how, demand determines the types and amount of materials that are recycled in a particular region.

Public interest in recycling has increased dramatically over the last 15 years throughout the industrialized world, and is presently gaining ground in developing world. This interest has been driven in the developed economic by a variety of factors including concerns about increasing waste generation and dwindling landfill capacity, air pollution from incineration and a general appreciation of the need for environmental protection. In response, a wide array of policies regulations and program has been implemented (Abubakar, 2006).

By reducing the total amount of waste headed for landfill or left lying to decompose in the street, recycling and composting are land saving and pollution reducing strategy (Richard 2002). The author also revealed that material recycling minimizes further exploitation of scarce natural resources.

According to the study by Pieter and Vinod (1996), recycling has an important role in the industrialization process particularly in developing countries.

Primary materials are generally more expensive, require more energy and more polluting in the production process than secondary materials. Also the technologies used in recycling process are often less sophisticated. The major constraint however, is lack of stable supply of raw materials.

In another development, Media (2002) reported that factories that consume recyclable materials can be built for a fraction of the cost of building plants that consumes virgin materials. In addition, recycling can result in a more competitive economy, a cleaner environment, and also contribute to a more sustainable development. On the other hand, considering the high proportion of organic matter in the waste generated in developing countries (typically over 30%), composting can be an option to reduce the amount of waste that are land filled, thus extending their life span. However, the health and social impacts include odor and unsightliness (Garrod and Williis, 1998). Additionally, many of the micro organism found in compost are no respiration sensitizer that can

cause a range of respiratory symptoms including asthma, and chronic bronchitis (Swan, 2002).

The feasibility of MWS composting as one step in the city-wide waste management system however, depends on the market for the compost product, as well as the technical and organizational set-up on the individual plants (Zurbruga, 2003).

Solid waste generation rates:

Result of waste generation rate are presented in table I. from the data obtained the average generation rate is 0.52kg/head/day.

Table I: **Waste generation per capital per day:**

Income group		**generation rate (kg/head/day)**		
Ada. North		Ada. Central	Ada. South	Average
Low	**0.35**	0.32	0.38	0.35
Medium	**0.50**	0.55	0.55	0.55
High	**0.70**	0.65	0.74	0.69

Waste Composition Analysis:

Result of composition analysis in the study area is presented in Table 2. The results indicate variation from one income area to another and from one community to the other within the same income class. Organic wastes which constitute the largest portion of the waste stream mainly consist of leaves, yard trimmings, garbage/food waste, agricultural waste grass etc. Hazardous waste, agricultural waste constitutes the least portion and consists mainly of herbicide/insecticides, pharmaceutical containers, dry cell batteries etc.

Table 2: **Results of Waste Composition Analysis**

Classes of waste	**Weight in Percentage**		**Study zone/income class**					
Adamawa North			Adamawa Central			Adamawa South		
	Low	**Med**	Low	Med.	High	Low	Med.	High
Organic-	**55.6**	**46.4**	53.5	48.4	407	54.3	47.3	30.2
37.1								

Paper -	**4.3**	**12.5**	**20.5**	5.4	10.5	21.5	5.6	11.5	20.8
Plastic/Rubber	**-5.1**		**8.0**	5.7	10.4	11.7	6.4	8.3	12.7
12.2									
Metal -	**0.5**	**2.3**	**4.5**	1.0	3.5	6.5	1.6	4.3	6.5
Glass -	**0.4**	**1.3**	**4.7**	0.8	2.3	4.3	0.8	2.3	4.8
Ash and Dust-	**1.0**	**3.5**	**9.2**	9.4	12.4	2.7	19.4	12.5	4.6
Consum. prod-	**1.0**	**3.5**	**9.2**	0.6	3.2	8.1	1.5	4.2	9.3
Hazardous-	**0.5**	**1.5**	**1.8**	0.2	1.0	0.5	0.6	1.4	1.8
Others -	**11.0**	**10.0**	**8.5**	13.4	8.3	5.0	9.7	8.2	9.3

Table 3. Average Composition of Waste in Adamawa State

Classes of waste	**Weight in Percentage**			**Income class**
	Low	Med.	High	Average
Organic	54.8	47.3	36.0	46.1
Paper	5.1	11.5	20.9	12.5
Plastics/Rubber	5.7	8.9	5.8	3.4
Metal	1.0	3.4	5.8	3.4
Glass	0.6	1.9	4.8	2.4
Ash & Dust	20.1	13.1	2.9	11.0
Consumer product	1.0	3.6	8.9	4.5
Hazardous	0.4	1.3	1.4	1.0
Others	11.3	8.9	7.6	9.3

Waste Recovery:

Result of solid waste recovery analysis is presented in table 4. The results indicate that, metal and plastic/rubber were the most recovered waste materials in all the zones. There was however, a variation in percentage recovery from one zone to the other. The other materials are not indicated were not recovered during the study.

Table 4. Results of waste Recovery Analysis

Types of waste Fraction of materials recovered as percentage of the category generated

	Ada. North	Ada. Central	Ada. South	Average
Plastic/Rubber	31.7	65.7	32.2	43.2
Metal	34.5	78.4	30.6	51.5
Glass	16.2	25.1	14.3	18.5

Consumer prod	15.7	20.8	16.6	17.7
Hazardous	6.3	3.4	4.3	4.7

Solid waste materials recovered as a percentage of total waste generated at household level was approximately 6%.

DISCUSSION

Sources and Rate of Waste Generation:

The identified sources of waste in the study area include; Household, commercial, agricultural industrial, institutional (e.g schools, hospital, hotel etc) and municipal (street sweeping and roadside litter, landscape and tree trimmings, dead animals etc) household waste only.

The finding revealed that, activities that constitute major sources of waste in the study area vary from community to community, depending on population density, culture, religion, belief etc. in low density area, agriculture activities are the major source of waste generation in form of straws, stalks and stem of plants, animals dung and carcasses. On the other head, commercial activities and in few cases industries are the major sources of waste in densely populated area.

However, in all cases, household activities are one of the major sources of waste generation in the state.

In some communities, religion and beliefs prohibits the rearing of certain domestic animals such as pigs and activities such as local beer production which contributes largely to waste generation and composition.

From the results waste generation analysis average generation rate is 0.52kg/head/day. The results however indicated that generation rate varies with income and from community to the other.

The trend shows that the higher the income, the higher the rate of waste generation. This could be due to higher purchasing power of the high income earners and hence more waste generation.

Waste Composition Analysis:

Results of waste composition analysis (table 2) indicate that composition of waste varies from one income group to the other and from community to community depending on culture, belief and tradition.

Some community's belief within the study area is that, food remnants must be excess food remnant after every meal as a sign of full satisfaction of every member. These for instance dictate the amount of food waste in a waste stream. In general, the analysis indicates that, low income class has the highest organic waste (leaves, yard trimming, agricultural waste, etc) while paper waste is highest in higher income areas basically due to large amount of packaging paper and newspaper. The overall average show that, organic waste constitutes the largest portion of the waste with 46.1%, followed by paper 12.5%, ash and dust 11.1%, while hazardous waste constitute the least portion with an average of 1.0% of the total waste generated at household level in the study area.

It is worthy to note that, agricultural waste inform of straws, stems, stalks, manures, etc represent about 10% of the total waste in the study area.

This is also about 12.7% of the organic waste showing that the study area is dominated by agricultural activities especially the low income areas. Polythene shopping bags (black film), packaged water bag (pure water) and bottled water containers altogether represent 2% of the total waste, and about 23.4% of plastic/rubber waste.

The result show a decreasing trend of ashes and dust from a higher percentage in low income to a negligible value in high income areas. This is linked with cooking activities with the use of fine wood and other solid fuels in low income areas this being relatively cheap and readily available while high income areas use different sources of energy for cooking and related activities.

On the other hand, there is an increasing trend of plastics, metals and glass waste mainly due to high plastics, metals and glass packaging container and also glass houses in high income than the other two income areas.

Waste Recovery Analysis:

From the results of waste recovery analysis (table 4), waste metals were the most recovered items with about 51.1% of the waste metals generated at household being recovered. This followed closely by plastics and rubber waste with about 43.2% recovery. The trend is linked to established trade existing between the recycling cities and itinerant buyers in the study area dealing in this category. Sometimes money is given to the retailers inform of soft loan or agreement to enhance their purchasing power. On the other hand, about 18.5% of waste glass in the form of bottles, containers (lotion, cream, medicine, etc)

was recovered mainly for reuse while broken pieces are ignored showing that the purpose is not for recycling.
It appears that the major trading in this category is not yet established.
Similarly, consumer products such as electric heater/cookers, stereo/video equipment, old telephones and stoves are recovered from waste stream by mostly children (who are into waste collection for a fee and scavenging) either for personal use or for sale to technicians who carry repair work on such items.
Hazardous waste such as pesticides/herbicide containers, medicine/pharmaceutical containers, dry cell battery, etc, are mainly the category of hazardous waste recovered for personal reuse or for sale.
In all category, waste material recovered on average as a percentage of total waste generated at household level is about 6%.

CONCLUSION

Waste materials recovery in Adamawa state is mainly undertake by informal sector with no form of support or repression from government and other sectors. Lack of adequate capital and purchase centre's at grass root, contamination of recovery items (lack source separation of waste), low price, and far distance between potential users and waste generation centre's are the main problems confronting waste recovery in the study area.
Composition of waste generated at household level was found to vary with income per-capita, social customs' and belief among others. Average composition however indicate that, organic waste constitute the largest portion with 46.1% while hazardous waste is least with 1.0% generation rate was also found to vary with individuals income among other factors. The average generation rate is 0.52kg/head/day.
Recovery of some category of waste such as plastic rubbers, metals and synthetic materials especially vehicle tyres in high. Combined efforts of public, private, government, informal sectors and industries is required to boost material recovery and utilization in the state based on evaluation of the information obtained.

Recommendation

The following recommendations are made based on the following of the study;

- There should be regular sensitization program especially at grass root level on the benefits of material recovery. The source separation of

waste material should be financed by government, industries and private organizations.

- There should be adequate recycling programs by manufacturing industries in Adamawa state.
- There should be proper recognition and adequate support program for informal sectors waste collectors and scavengers.
- Seasonal variation of waste composition and generation should be investigated in detail to provide data for proper planning of waste management and resource recovery.

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