

# Residents' knowledge of waste reduction, reusing and recycling in Makurdi metropolis, Nigeria

M. S. Awopetu<sup>1</sup>, A. O. Coker<sup>2</sup>, R. G. Awopetu<sup>3</sup>, S. O. Awopetu<sup>4</sup>,  
A. A. Ajonye<sup>3</sup> & O. W. Awopetu<sup>5</sup>

<sup>1</sup>*Nigeria Security and Civil Defence Corps, Benue State Command, Makurdi, Nigeria*

<sup>2</sup>*Department of Civil Engineering, University of Ibadan, Nigeria*

<sup>3</sup>*Department of Psychology, Benue State University, Makurdi, Nigeria*

<sup>4</sup>*Department of Environmental, Civil and Geomatic Engineering, University College, London, UK*

<sup>5</sup>*Department of Civil Engineering, University of East London, UK*

## Abstract

This study focused on residents' knowledge of solid waste reduction, reuse and recycling (3Rs) as sustainable solid waste management (SSWM) options in Makurdi metropolis, a rapidly growing urban city in the North central (middle belt region) of Nigeria. The area surveyed covered low (zone I), medium (zone II) and high- density (zone III). Data used for this study were collected by the use of literature search, administration questionnaire (n=560), formal and informal interviews, and observational checklists. Analyses of the data revealed that > 72% of the respondents in the three environmental zones are aware of the fact that solid waste can be reused, reduced and recycled. The trouble is, merely knowing something is not, by itself, sufficient to generate beneficial outcomes. There is a need for the residents to be educated or informed on how solid waste can be reused and reduced from source. The Government needs to put uninterrupted electricity supply in place as a basic ingredient for small medium and large scale industry. The market for recyclable products should also be strengthened.

*Keywords: solid waste management, waste minimization, reduction, reuse, recycling, practices, Nigeria.*



## 1 Introduction

Solid waste could be regarded as “resources in the wrong place” (Adewumi *et al.* [1]). In nature, there is essentially no solid waste because the wastes of one organism become nutrients for other organisms. Man existence will always produce some solid wastes either directly and or indirectly in creating the goods and services we use. Much of solid waste we produce represents an unnecessary waste of the earth’s precious resources.

Wherever people exist, waste disposal is likely to constitute a problem. From prehistory through the present day, the favoured means of disposal was simply to dump solid wastes outside of the city or village limits. Frequently these dumps were in wetlands adjacent to a river or lake. To minimize volume of the waste, the dump was often burned. Unfortunately, the above scenario depicts the situation in Makurdi metropolis in particular and Nigeria in general. As better solid waste management/disposal technologies were developed and as values changed, more emphasis was placed on the environment and quality of life. Dumping and open burning of wastes is no longer an acceptable practice from an environmental and health perspective. In developed countries, the technology of waste disposal has evolved during some decades in the past. Many developed countries have widely accepted that solid waste management options should be selected based on a waste management hierarchy of waste reduction, reuse, recycle, composting, incineration and land filling.

The sheer magnitude of the solid waste problem in Makurdi metropolis, Nigeria is hard to comprehend. The public waste bins are either not available or grossly inadequate; the amount of trash that accumulates in a matter of hours is more than what waste collectors can haul in a day. The garbage dumps are located in the side of the highway at the fringe of cities and slums. Trash often spread into the road, blocking traffic.

The problem of solid waste in every city in Nigeria including Makurdi metropolis is multifaceted. These ranges from the government’s lack of clear formulated policies aims at coordinating and monitoring the relationship between environmental management and sustainable development. Secondly, it is estimated that nearly 10% of the population live below national poverty line (World Bank [2]). As a result of the enormity of the problem of solid waste in Nigeria, several attempts have been made by the government and researchers to find a sustainable solution to the solid waste menace.

To lessen the burden of solid waste management on government, individual and environment, there is a need to critically look into waste reduction, reuse and recycling as feasible options in tackling the issue of solid waste management in Makurdi metropolis and Nigeria in general. Hence the study was predicated on the following objectives: (1) to assess the residents’ knowledge of waste reduction, reusing and recycling in Makurdi metropolis; (2) to determine the feasibility of reducing ,reusing and recycling solid waste in Makurdi metropolis and; (3) to recommend how waste reduction, reusing and recycling can be achieved in Makurdi metropolis.



## 2 The study area

The study area, Makurdi metropolis is the capital city of Benue State in the middle belt region (north-central part) of Nigeria. According to Wikipedia [3], Benue has a Gross Domestic Product of \$1.592. It is a typical example of a Nigeria city with mixed population characterized with diverse cultural background. Prominent among the ethnic group in Makurdi metropolis are the Tivs, Idomas, Igedes, Hausas, Yorubas, and Ibos etc. According to the National Population Census Report [4], the population of Makurdi was put at 297,398. It has an estimated area of 41,035 km<sup>2</sup>. Makurdi Local Government Area which essentially traverses the Benue State Capital is the most densely populated Local Government Area in Benue State with an average of 257 persons per km<sup>2</sup>. It lies between longitude 6° 45' and 8° 15' E and latitude 7° 30' and 9° 45' N.

The city experiences 7–8 rainy months with the highest rainfall and rainy days in September. Monthly minimum temperature fluctuates between 17.5–18.5°C in December and January and 25.7 °C in April. Relative humidity at 0900 hours is high in July with 78.5%. Highest relative humidity at 1500 hours is 70.6% in the month of August. The mean daily sunshine period is 4.9 hours in July and 7.2 hours in November. The relief flanking the flood plains around Makurdi is between 76m and 82m above the sea level. Absence of outcrops of rocks allow for free flow of the rivers without rapids thereby revealing shallow depths of large volume of sand deposit.

## 3 Research methodology

In order to obtain the required data and information, the study which was conducted between July and September 2009, employed a methodology that include literature search, questionnaire administration, formal and informal interviews, and use of observational checklists. For the collection of data, the study area was partitioned into three zones (table 1).

Table 1: Environmental zones delineated in Makurdi.

Zone	Name of the area	Area(km <sup>2</sup> )	Population/km <sup>2</sup>	Density Classification
I	Madikpo/Wadata	9.38	4.1	High
II	Lobi/Wadata	15.78	536.0	Medium
III	Old Government Reserved Area	15.88	88.0	Low

The zones tend to exhibit different characteristics in solid waste generation, awareness, attitude and participation in solid waste management. The population density/land use intensity criteria were used to delineate the study area into zones I, II, III (figure 1). The study area selected in each zone was based on the following characteristics: (a) Solid waste management has been clearly identified as a serious problem; (b) Home of people with different ethnic backgrounds and; (c) Relatively planned area for ease of administration of questionnaires. The

questionnaire (n = 560) was then distributed across the three zones (in compliance with the University of Ibadan ethics code). Upon return of the data (n = 545; 97.3% response), descriptive statistical analysis was applied.

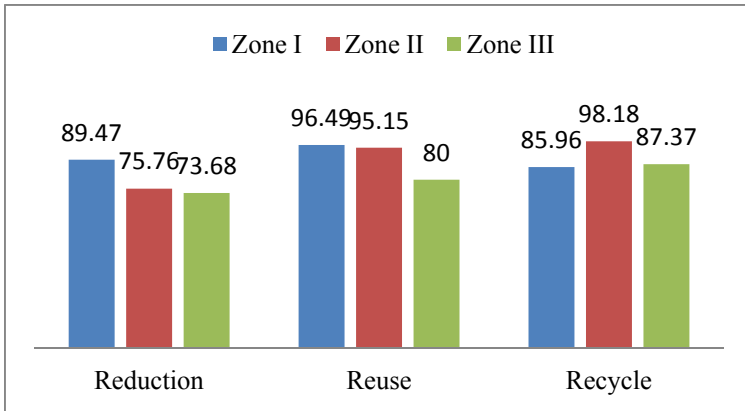


Figure 1: Residents' awareness of solid waste reduction, reusing and recycling across the three environmental zones in Makurdi metropolis.

#### 4 Result and discussions

Compositional analysis of solid waste in the Makurdi Metropolitan area (Table 4) indicated a high percentage of waste throughout all the zones is putrescible (57.5, 53.7 and 36.4% of solid waste composition in Zone I, Zone II and Zone III, respectively). The study reveals a very high degree of awareness of the importance of solid waste reduction in the fight against the problems of waste management across the study area (Tables 2 and 3). Analysis of the data collected shows a little variation in the residents' knowledge of waste reduction, reuse and recycling. More than 65% of the residents in the three environmental zones (Fig. 1) agreed that solid wastes can be reduced, reused and recycled.

Table 2: Respondents' knowledge of waste reduction, reuse and recycling (n=285).

Statement	Respondent	Zone I	Zone II	Zone III
		Frequency n (%)	Frequency n (%)	Frequency n (%)
Waste can be reduced from the source	Agree	255(89.47)	125(75.76)	70(73.68)
	Disagree	30(10.53)	40(24.24)	25(26.32)
	Total	285(100)	165(100)	95(100)
Waste can be reused	Agree	275(96.49)	157(95.15)	76(80)
	Disagree	10(3.51)	08(4.85)	19(20)
	Total	285(100)	165(100)	95(100)
Waste can be recycled	Agree	245(85.96)	162(98.18)	83(87.37)
	Disagree	40(14.04)	03(01.82)	12(12.63)
	Total	285(100)	165(100)	95(100)

Table 3: Analysis of variance (ANOVA) of differences in the three zones.

Statement	n	Mean	Standard Deviation	Sum of Squares	df	Mean Square	F	Significance
Waste can be reduced from the source	<sup>+</sup> 391	7.532	4.288	<sup>#</sup> 8.988	1	8.988	0.558	0.055 (NS)
	<sup>++</sup> 154	7.247	3.202	<sup>##</sup> 8739.974	543	16.096		
	<sup>###</sup> 545	7.451	4.010	<sup>####</sup> 8748.961	544			
Waste can be reused	<sup>+</sup> 391	5.361	1.000	<sup>#</sup> 1.432	1	1.432	1.312	0.023*
	<sup>++</sup> 154	5.247	1.151	<sup>##</sup> 592.777	543	1.092		
	<sup>###</sup> 545	5.328	1.045	<sup>####</sup> 594.209	544			
Waste can be recycled	<sup>+</sup> 391	6.056	1.180	<sup>#</sup> 1.002	1	1.002	0.733	0.039*
	<sup>++</sup> 154	5.961	1.427	<sup>##</sup> 742.528	543	1.367		
	<sup>###</sup> 545	6.029	1.169	<sup>####</sup> 743.530	544			

\*Significant at  $P < 0.05$ , NS = Not significant.

<sup>+</sup>Low income (mean monthly income of \$100).

<sup>++</sup>High income (mean monthly income of \$500).

<sup>#</sup>Between group.

<sup>##</sup>Within group.

<sup>###</sup>Total.

Table 4: Typical composition of solid waste in Makurdi urban area by generation.

Waste source	Waste category							
	Putrescibles <sup>a</sup>	Plastic/cellophane	Paper	Metals <sup>b</sup>	Glass	Textile	Fines <sup>c</sup>	Miscellaneous <sup>d</sup>
LoDA	57.5	6.10	4.30	2.50	2.30	2.90	21.0	3.40
MeDA	53.7	7.10	4.10	2.01	1.70	2.40	27.1	1.70
HiDA	36.4	8.04	2.59	1.75	0.86	3.67	41.0	5.73
COMM	27.9	10.2	10.9	3.40	6.90	1.20	36.4	3.10
INS	44.8	5.90	8.90	0.90	1.20	0.30	36.4	3.10
SMI	23.4	7.01	2.10	0.70	0.10	6.10	31.7	28.9
MART	36.1	6.86	3.20	1.10	0.10	1.90	48.7	2.01

Source: Sha'Ato *et al.* [5].

LoDA = low density area; MeDA = medium density area; HiDA = high density area; COMM = commercial premises; INS = institutional premises; SMIs = small/medium scale industry; MART = Wadata market.

<sup>a</sup>Putrescibles includes food remnants, fresh and decaying leaves, vegetations, etc;

<sup>b</sup>Metals – mostly cans and bottle caps; few ferrous metal and aluminium items;

<sup>c</sup>Includes ash, dust and sand;

<sup>d</sup>Other includes wood, stones and pebbles, discarded shoes and other footwear, wood shavings. (from carpenter's shop); Styrofoam, snail shells, discarded dry cells, etc.

#### 4.1 Solid waste reduction

Overall, >73% of the respondents were aware of the great dividend that could be realised from effective cutback in the production of waste. The trouble is, merely knowing something is not, by itself, sufficient to generate beneficial outcomes.



The continuing exponential growth of solid waste generation in the study areas suggests that the widespread knowledge of the need to cut back on waste production is hardly producing practical beneficial effects. Knowledge must be backed by willingness and ability to act upon it.

It should be noted that we can deal with the waste we create in two ways: waste management or waste reduction. Waste management is a high-waste approach that views waste as a mostly unavoidable product of economic growth. It attempts to manage the waste that results from economic growth in ways that reduce environmental harm, mostly by mixing and often crushing wastes together and then burying them, burning them, or shipping them to another location. In effect, it commingles waste and then transfers them from one environment to another.

Waste reduction on the other hand is a low-waste approach that recognizes there is no “away.” It mimics nature by viewing solid waste as potential resources that we should be reusing, recycling or composting. Waste reduction is the most preferred solution because it tackles the problem of waste production front end before it occurs rather than at the back end after the wastes have already been produced. Waste reduction at source should be vigorously pursued (Sangodoyin and Coker [6]). It also saves matter and energy resources, reduces pollution (including emissions of greenhouse gases), helps protect biodiversity, and saves money.

#### **4.2 Solid waste reuse**

Waste reuse involves cleaning and using materials over and over, thereby extending the typical life span of a product. Reusing items is a way to reduce waste at the source because it delays or prevents the entry of reused items into the waste collection and disposal system. It was found out that 96.49%, 95.15% and 80% of respondents in zone I, zone II and zone III respectively knew and thereby agreed that solid waste can be reused. In spite of the fact that residents know that some kind of solid waste can still be reused, it is disheartening to note that often than not, solid wastes are discarded without consideration for reuse in the high income earners located in zone III.

Locally within the Makurdi metropolis, form of reuse include salvaging automobile parts from old cars, salvaging, bricks, doors, fine woodworks and other items from old houses and buildings. Waste scavengers move from one house to the other practicing trade-by-barter by exchanging different types and sizes of brand new plastic/rubber containers with equivalent quantity of old dresses. The old dresses are no longer useful to the owners but are still useful to the waste buyer who after collecting the dresses will dry-clean and sell them to the poor.

It is pertinent to note that in developed countries, the societies have increasingly substituted throwaway tissues for reusable hand kerchiefs; disposable paper towels and napkins for reusable cloth ones; throwaway beverage containers for refillable ones. Whereas in Nigeria, the reusable baby napkins are being replaced by disposable pampers; all the bottled water and sachet water are disposable; all the yoghurt available in Nigeria market are

packaged in disposable containers; beverages in disposable containers are increasingly popular in Nigeria with little or no attention to its economic and environmental disadvantage.

Reuse is thriving in most developing countries but can pose a health hazard for the poor. About 80% of the United States' e-waste, including discarded computers and cell phones, are shipped to China, India, and Pakistan, and other countries where labour is cheap and environmental regulations are weak (Miller [7]). For workers in these countries, many of their children are engaged in dismantling the products to recover reusable parts and are thus exposed to toxic metals such as lead, mercury, and cadmium. Nigeria's electronic market is flooded with e-waste from European and American countries. It is stating the obvious to say that all electronics that are available in brand new model are also available in fairly used versions. Apart from the fact that the fairly used are economically cheaper, they are believed by the users to be more durable.

In cities and towns such as Makurdi metropolis, large number of people, many of them children, eke out a living by scavenging for materials they can sell for reuse or recycling from open city dump sites. This practice exposes them to toxins and infectious diseases.

### 4.3 Solid waste recycling

Recycling is a series of activities that includes collection of recyclable materials that would otherwise be considered waste, sorting and processing recyclables into raw materials such as fibers, and manufacturing raw materials into new product. It was observed that 85.96%, 98.18% and 87.37% of residents in zone I, zone II and zone III respectively agreed that waste can be recycled. The result shows that the residents have knowledge of converting wastes to other useful items. Composition of solid waste in Makurdi urban area (Table 2) indicated that 57.5%, 53.7% and 36.4% of solid waste composition in LoDA (zone I), MeDA (zone II) and HiDA (zone III) respectively are putrescibles. This is an indication that effort could be channeled towards composting.

The percentages of plastic, paper, metals, glass and textile are relatively low. However, this may not warrant siting of material recovery facility in the metropolis. Manual sorting of these recyclable material should be encouraged.

## 5 Conclusion

An environment with a high standard of sanitation that is both clean and beautiful has a greater influence on our psychological, emotional and social well being. It enhances public health and our quality of living (Agbede and Ajagbe [8]). Solid waste management in Makurdi metropolis no doubt is a critical issue. The war against inefficient and ineffective SWM must be declared and won. This became imperative if good quality of life and sustainable environment must be maintained.

The current scenario of solid waste management in Makurdi metropolis is to collect Solid Waste (without sorting) from the metropolis and dump it at the



dump site. This system is barbaric and unacceptable socially and environmentally. The current solid waste management paradigm must shift to a socially acceptable, economically viable and environmentally-friendly solid waste reduction, reuse and recycling. A major step towards an effective solid waste management is to raise public awareness on the importance of creating a healthy environment as well as mechanism of controlling generation of solid waste at source and providing an alternative disposal means (Coker *et al.* [9]).

39.97 % of urban wastes generated in Makurdi metropolis are organic in nature. The best use for these wastes is to utilize it in biogas production. According to Sridhar *et al.* [10], “Biogas is essentially a rural technology. However, it has the ability to be adapted for urban and peri-urban areas. Classical plants utilized human excreta and animal waste. The future lies in utilizing urban waste particularly food waste. Another of biogas technology which was not adequately considered in developing countries is tapping from city refuse”

Any activities that reduce the amount of waste produced will definitely reduce the cost of waste disposal. That is why solid waste reduction, reuse and recycling are highly beneficial to a metropolis such as Makurdi in a developing country where it is estimated that nearly 10% of the population live below national poverty line (World Bank [2]). There are however important environmentally sound lessons that can be learned from the poor with respect to both the reduction of waste and its reuse [11]. It is a common practice in Makurdi metropolis for lower income people to buy used clothes for reuse and make use of use plastic material, paper and tin cans.

The study has shown that above 72% of the respondents have the knowledge that solid waste can be reduced, reused and recycled. However, it should be noted that having knowledge that waste can be reduced from source does not mean that they have knowledge of how to reduce waste from source. For the fact that residents know that waste can be reused does not mean that they are reusing wastes. There is a need for the residents to be educated or informed on how solid waste can reduced from source

The residents need to be informed that one vital way of dealing with issue of reducing waste is not to generate it at all. Before buying anything at all, questions should be asked: Do I just want this thing or I really need it? Can I put pride aside and borrow it (reuse)? Can I rent it? Can I buy it? Honest answers to these questions will lead to the best step to take that will be socially acceptable, economically viable and environmentally friendly. Any activities that reduce the amount of waste produced reduce the cost of waste disposal, the amount of raw material needed, amount of pollution generated and the better for our dear environment.

Recycling on small or large scale requires a substantial capital which is neither readily assessable nor available. This is an area where government and private investors have to be involved. Government need to put uninterrupted electricity supply in place as basic ingredient for small medium and large scale industry. Market for recyclable products should also be strengthened. The role of women in solid waste management at household level should not be overlooked. In the traditional Nigeria societies, domestic activities such as





provision of water for general household use, maintaining a clean environment in the house by disposing household wastes and maintaining sanitation facilities, have been delegated to the women of the community (Coker *et al.* [12]). However, sustainability of solid waste management activities such as waste reduction, reuse and recycle without paying due attention to women's role can hardly achieve its objectives. A survey by the United Nation's Children's Emergency Fund (UNICEF [13]) has revealed that developmental projects which did not involve women failed to realized their full objectives.

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