MIXED PLASTIC WASTE AS AN INTRACTABLE ENVIRONMENTAL PROBLEM IN ABUJA, NIGERIA

Kadafa, A.A[1], Ayuba, H.K[1] and Idris N.M[1]
[1]Department of Geography, Faculty of Social Sciences.
Nasarawa State University Keffi, Nigeria
E-mail: kwaala@yahoo.com (**Corresponding Authors)*

Abstract: The greatest environmental issue in the urban areas of Nigeria is solid waste management and the most intractable are the mixed plastic wastes. Mixed plastics, especially Polypropylene (PP/5) found in confectionery packets and Polyethylene Terephthalate (PETE/1) found in soft drinks bottles are commonly used as packaging materials by the manufacturing sector within the country. Due to the high rate of generation, these mixed plastics are found in abundance littering major streets of Nigeria. The greatest challenge is that these mixed plastics are non-biodegradable and therefore cannot be used as compost by the local communities and Government does not also seem to possess the capacity to recycle them. This paper examines mixed plastic waste in Abuja, Nigeria and its environmental hazards with the aim of sensitizing solid waste managers and the general public to finding sustainable solutions to the problem. Survey method was used to administer 400 questionnaire to residents of Abuja, Nigeria. The results indicated only 43% of residents have waste collection services available to them, with infrequent collections. Which corresponds with the high percentage of resident who use dumping; 65.7% as a method of disposing their waste. With alot of plastic waste being generated thus results in alot of plastic waste found littering the environment.
Keywords: Plastic, Waste, Management, Abuja, Nigeria.

Introduction

Prior to the industrial revolution individuals needs were more basic thus the consumption patterns and waste fraction were predictable. Management of waste till possessed a problem but the magnitude was low. The industrial revolution brought about technological advancements, and with that the emergence of new waste fraction that made waste management a challenge. Coupled with the increasing population, increasing urbanization and social status were evolving and with that consumption of more diversified goods thus creating more diversified waste fractions.

Plastics are polymers made up of long repetitive molecules are primarily made of carbon the birth of the modern plastics era - came in 1907, with the invention of Bakelite by the Belgian-born American Leo Baekeland (Laurence, 2014). It was the first synthetic plastic the first to

*Received Jan 27, 2017 * Published Apr 2, 2017 * www.ijset.net*

be derived not from plants or animals, but from fossil fuels (Laurence, 2014). Baekeland used phenol, an acid derived from coal tar. His work opened the floodgates to a torrent of now-familiar synthetic plastics; polystyrene in 1929, polyester in 1930, polyvinylchloride (PVC) and polythene in 1933, nylon in 1935(Laurence, 2014).

Plastic comes In different types and form (mixed plastic) and there are there are more than 100 types of plastic, but only six are commonly found in MSW - all of which are thermoplastics:

1. Polyethylene Terephthalate (PET) – e.g. soft drinks bottles, video tapes, X-ray film
2. High Density Polyethylene (HDPE) – e.g. detergent bottles, pipes
3. Low Density Polyethylene (LDPE) – e.g. Clingfilm, playground slides
4. Polyvinyl Chloride (PVC) – e.g. insulation on electric wires
5. Polypropylene (PP) – e.g. hinges, lids of confectionery packets.
6. Polystyrene (PS) – e.g. yoghurt pots, CD cases, foam protection for packaging

Its usage is very extensive especially in production sector. Its extensive usage is quite evident in food production, for product packaging such as food wrapper cellophane, drinks bottles. With increasing consumption patterns this has led to its high quantity in waste fractions.

In Nigeria, plastic is a cheap packaging material with no usage restriction imposed on the production sector. It is abundantly found littering most areas in Abuja, thus an aesthetic nuisance. It can be found filling up gutter, waterways and storm drains all over the city, especially the suburbs. Thus mixed plastic waste has become an environmental nuisance in Abuja, Nigeria.

Presently recycling is not legally imposed in any sector in Nigeria. All current recycling programs are optional and carried out by the private sector. The private sector recycling programs are small scale and not extensive. In **Table 1** mixed plastic waste accounts for 17.9% of the annual waste fraction generated in Abuja. (AEPB, 2012).

Table 1: Annual Waste Compositions

Type of Waste	Tonnage	Percentage
Paper	16112.94	25.3
Textile	1930.31	3.03
Plastics	14615.51	17.9
Glass	2250.388	3

Metals	2642.804	3.14
E-waste	1786.33	2.8
Organic materials	28420.76	42.6

Source: (AEPB, 2012).

The waste fraction for statistic in Table 1 only accounts for the 43% of total waste that is collected by AEPB from a population of estimated over 4 million by the Nigerian population commission (NPC, 2012).

Apart from the blockage of wastewater pipes and drainage pipes and causing artificial flooding due to blocked drainages. Researchers have also established plastic waste has been found to affect different area as shown in **Table 2**. It affects crops ranging from reduction in soil aeration and penetration, water infiltration due to high bulk density, reduced plant growth and yield (Atuanya *et al. 2012,* Agbede *et al*., 2008; Mbah *et al*., 2004).

Table 2: Areas of Research on the Effects of Plastic Waste

Year/Author	**Areas of Impact**	**Impact Findings**
Boadi and Kuitunen, 2005	Environment & Health: Blocked storm drains, Stagnant water, Mosquitoes and other insects to breed more easily within a city, and transmit a variety of lethal diseases such as dengue, malaria, Yellow fever and Several forms of encephalitis	Negative
Rayne, 2008	Environment & Health: Stagnant water, Mosquitoes	Negative
Smith, 2009	Environment: Clogging of drainage systems, Flooding	Negative
Legesse and Diriba, 2011	Environment & Agriculture: Farmland and Rivers, Environmental beauty, Blockage of sewage	Negative
Atuanya *et al.* 2012	Agriculture: Soil Structure, Fertility and Growth of Maize Plants	Negative
Jalil, *et al.* 2013	Environment & Agriculture: Blockage of drains, Flash floods, Land pollution, Retard the progress of growth of agricultural plants, Aesthetic	Negative

The United Nations Sustainable Development Goals to be achieved by 2030 with regards to goal 6. It aims to ensure availability and sustainable management of water and sanitation for

all. 6.2 by 2030, to achieve access to adequate and equitable sanitation and hygiene for all and 6.3 by 2030, to improve water quality by reducing pollution, eliminating dumping and substantially increase recycling and safe reuse globally. Also goal 12; to ensure sustainable consumption and production pattern. 12.5 by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse (Https://Sustainabledevelopment.Un.Org).

Material & methods

Preliminary study is carried out to grasp an overview of the research; this is carried out through literature review and exploratory field survey. Survey method was used for the data collection; Questionnaires and field observations. The questionnaires were distributed using simple random sampling. The sample frame consisted of individual residing within Abuja, Nigeria.

With a population of 1, 406,239 (NPC, 2012) A 95% confidence level or p=0.05 is assumed for Equation 3.1 (Krejcie & Morgan, 1970; Fox *et al.,* 2009):

$$n = \frac{N}{1+N(e)^2} \qquad \text{Equation 1}$$

Where:

n _____=the sample size

N_____ =the population size

e _____=the level of precision

The population size for Abuja is 1,406,239 (NPC, 2012) and for Putrajaya 72,413 (DOS, 2012). Thus calculated:

$$n = \frac{1{,}406{,}239}{1 + 1{,}406{,}239(0.05)^2}$$

$$n = \frac{1{,}406{,}239}{3{,}516.5975}$$

$$n = 399.89$$

From the above formula and calculations, the sample size consists of approx. 400 for each case study. Large sample number is also recommended to ensure a higher statistical accuracy and confidence level (UNEP, 2009b; Gomez *et al*., 2009).The main variables were; generation, composition and practice.

Findings & discussion

In Abuja waste generation ranges between 0.5kg-2kg per day in as shown in **Figure 1**; 23.6% of residents generate approx. 0.5kg or less per day, 33.3% generate approx. 1kg per day,

21.2% generate approx. 1.5kg per day, 14.3% generate approx. 2kg per day and 7.6% generate approx. 4kg and above per day.

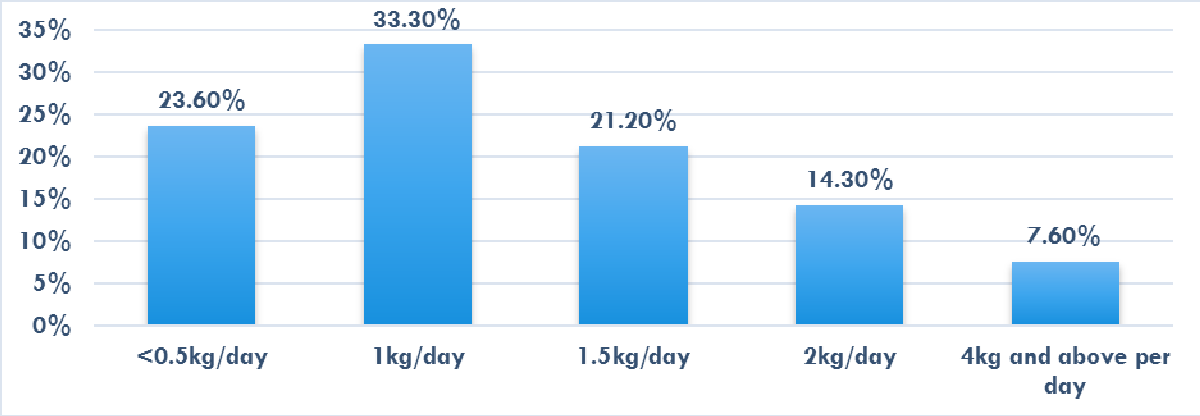


Figure 1: Estimated Daily Waste Generation per Household

In terms of waste compositions in Abuja; plastic waste make up 43.8% of weekly waste composition from households shown in **Figure 2**.

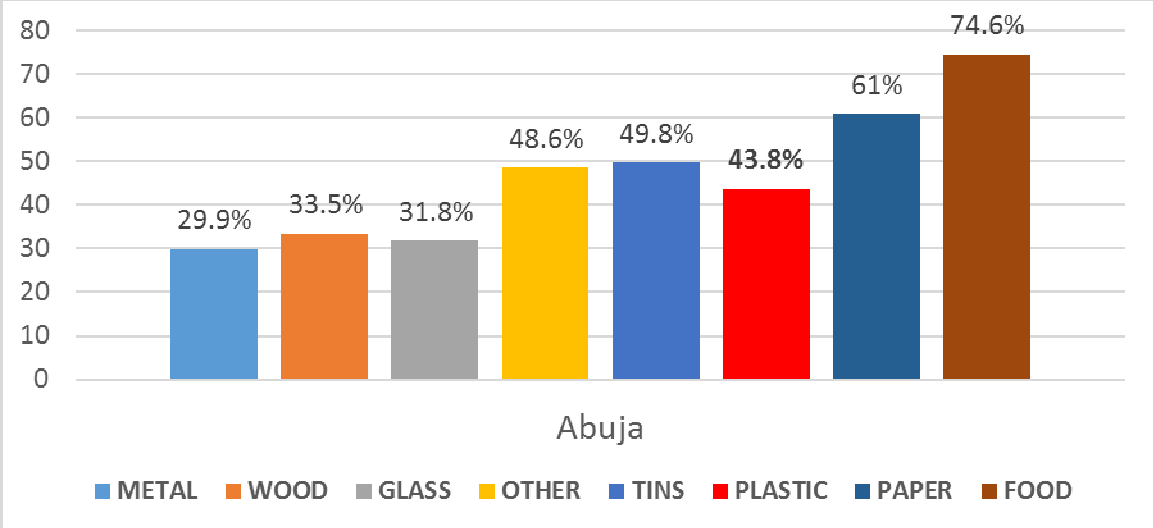


Figure 2: Weekly Waste Composition for Abuja

From **Figure 4** only 43% of Abuja residents have waste collection services by the local government or environmental protection board with mostly once weekly collection of waste; 45.1% as shown in **Figure 3**. This leaves 57% of residents not having waste collection services available to them by the local government or environmental protection board. This correlates the high percentage of open dumping by residents in the city and suburbs; 65.7%.

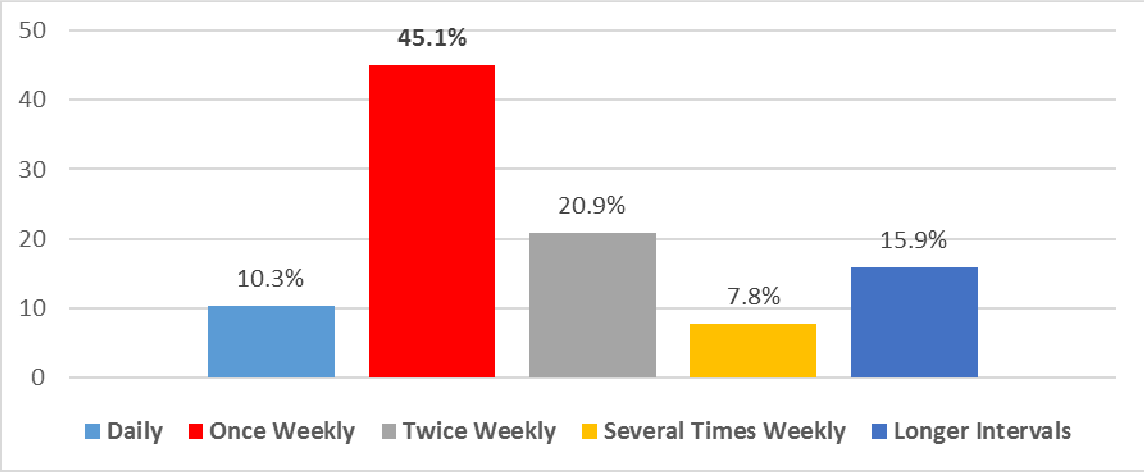


Figure 3: Waste Collection Frequencies for Abuja

From **Figure 4,** 65% of a population of over 4 million dumping waste within residential and open area. There is no formal recycling program presently in Abuja and a low percentage of informal recycling at 17% which is carried out by the private sector through scavengers. The scavengers go house by house to pillage through waste and at the landfill. Residents also sell directly to the individual interested in purchasing the recyclable materials

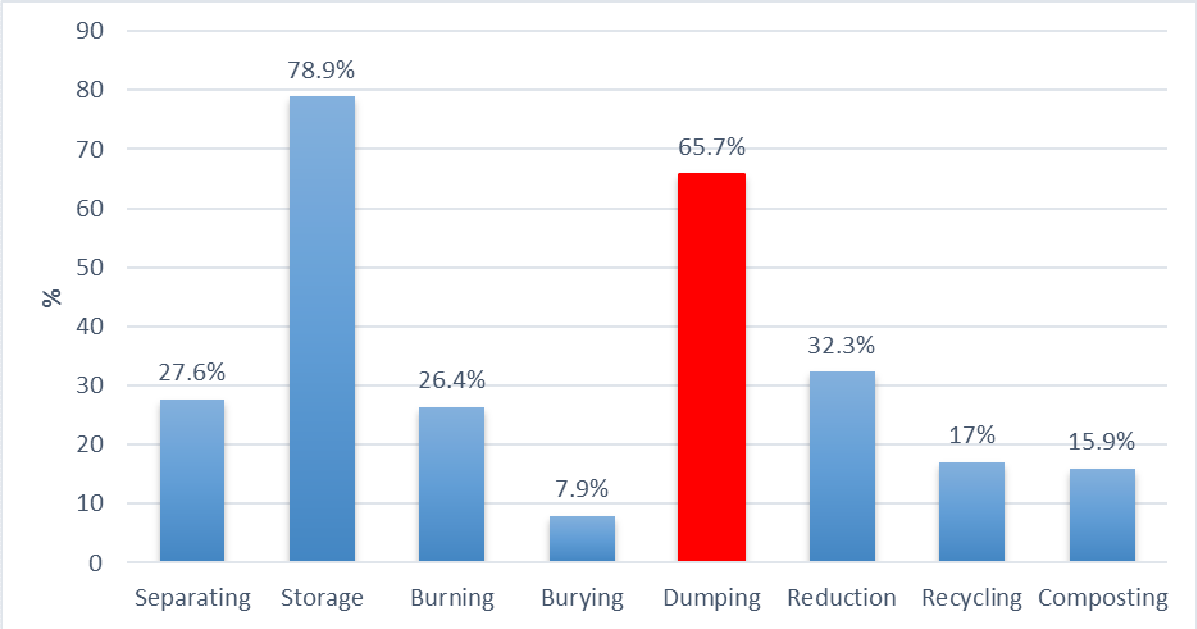


Figure 4: Resident Waste Management Practices for Abuja

Abuja Environmental Protection Board (AEPB) implemented once monthly environmental sanitation day which was initiated by the Federal Ministry of Environment. Residents are expected to clean their surrounding and clear blocked open drainages within their vicinity. This program generally improved the city sanitation but the effects are short lasting and

monitoring has become difficult over the years due to increased population. Also placement of community bins, neighborhood collection points and weekly evacuation of community bins are efforts put in place toward reducing the waste management evacuation problems in unplanned suburbs.

Due to large plastic waste fractions, infrequent collection, unregulated plastic usage and low recycling plastic waste can be found over flowing the community bins as in Figure 5, littering the city environment as in Figure 5-9 and clogging open drains and water ways as shown in Figure 7, 8 and 12.



Figure 5



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10

Conclusions

There is a lot of littering in Abuja, causing sanitation problems. Mixed plastic making up a large proportion of the litter; plastic store bags, plastic water bags and plastic beverage bottles. Even though it is quite difficult to control the consumption patterns of individuals. The bad sanitation and littering issues in Abuja cannot be resolve if the source of these mixed plastic litters are not regulated. The usage of mixed plastic in production process needs to be regulated ease thereby minimizing the quantities that end up on the streets.

Recommendations

1. Regulation of the production of polypropylene and all its categories in the production sector with stringent penalties
2. Legal enforcement of recycling of polypropylene in all packaging processes in the production sector with close monitoring and sever penalties for noncompliance and thus;
   - -This will also create jobs at no cost to the government
   - -Generate revenue
   - -A sustainable approach
   - - Improve sanitation and the aesthetics of Abuja
3. There is the need to look into the conversion plastic waste to fuel using the Philippines as a case study. With the depreciation of crude oil reserves and the electricity problems, this can be used to power domestic generator.

References

[1] Abdul Jalil, Nannu Mian and Muhammad Khalilur Rahman (2013). Using Plastic Bags and Its Damaging Impact on Environment and Agriculture: An Alternative Proposal. International Journal of Learning & Development, 3(4).

[2] Abuja Environmental Protection Board (AEPB) 2012.

[3] Agbede, T.M., Ojeniyi, S.O. and Adeyemo, A.J. (2008). Effect of Poultry Manure on Soil Physical and Chemical Properties, Growth and Grain Yield of Sorghum in South West Nigeria. American Eurasian Journal of Sustainable Agriculture, 2(1): 72-77.

[4] Atuanya, E.I., Aborisade, W.T. and Nwogu, N.A. (2012). Impact of Plastic Enriched Composting on Soil Structure, Fertility and Growth of Maize Plants. European Journal of Applied Sciences 4 (3): 105-109. DOI: 10.5829/idosi.ejas.2012.4.3.270.

[5] Boadi KO, Kuitunen M (2005). Environmental and health impacts of household solid waste handling and disposal practices in third world cities: the case of the Accra Metropolitan Area, Ghana. J. Environ. Health, 68(4): 32-36.

[6] Fox, N., Hunn, A. & Nigel Mathers, N. (2009). Sampling and Sample Size Calculation National Institute of Health Research. www.rds-eastmidlands.nihr.ac.uk. Accessed January 2nd 2011.

[7] Gomez, G., Meneses, M., Ballinas, L. & Castells, F. (2009). Seasonal Characterization of Municipal Solid Waste (MSW) in the City of Chihuahua, Mexico. Waste Management, 28:2018-2024.

[8] Krejcie, R.V. & Morgan, D.W. (1970) Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30:607-610.

[9] Legesse, A. and Diriba, M. (2011). Survey on the Usage of Plastic Bags, their Disposal and Adverse Impacts on Environment: A Case Study in Jimma City, Southwestern Ethiopia, Journal of Toxicology and Environmental Health Sciences. 3(8) pp. 234-248.

[10] Mbah, C.N., Mbagwu, J.S.C. Onya, V.M. and Anikwe, M.A.N. (2004). Effect of Application of Biofertilizers on Soil Densification, Total Porosity, Aggregate stability and Maize Gain Yield in Dystric Leptoso at Abakiliki, Nigeria. Journal of Science and Technology, 10: 74-85.

[11] Rayne S (2008). The need for reducing plastic shopping bag use and disposal in Africa. Afr. J. Environ. Sci. Technol., 3: 1-3.

[12] Smith LC (2009). Paper or plastic? The economic implications of plastic carrier bag legislation in the United States. A Thesis presented to the faculty of the Department of Economics and Business, The Colorado College, In Partial Fulfillment of the Requirements for the Degree Bachelor of Arts, pp. 34-36

[13] Laurence Knight 17 May 2014 A brief history of plastics, natural and synthetic Business reporter, BBC News http://www.bbc.com/news/magazine-27442625

[14] NPC. (2012). National Population Commission Nigeria. Retrieved from www.population.gov.ng. Accessed 16th April 2012

[15] UNEP (2009b). Developing Integrated Solid Waste Management Plan Training Manual: Waste Characterization and Quantification with Projections, 1. www.unep.org. Accessed October 2nd 2011.