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Assessment of the Development of a Medium Scale Waste Polythene Recycling Plant in Maiduguri; Generation, Recovery and Recycling

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Abstract: *This research is focused on generation, recovery and the recycling potential of polythene waste in Ramat polytechnic Maiduguri, Borno state. The waste generated per person was estimated by a collection scenario tested within the study area and validated using experimental and literature data. Data obtained was analyzed using simple statistical methods. The result estimated 554.4 tonnes/year of MSW and 166.32 tonnes/year of plastic/polythene waste were generated. An important amount of recyclable polythene material was found to be generated within the study area The developed model will be used to accurately predict the size and performance of the actual plant even at its virtual stage which will help improve the efficiency of the process and better understand the mechanism Involved.*

Keywords: *Municipal solid waste, generation, polythene/plastic waste, recovery, re-use, recycling, economy*

INTRODUCTION

In the recycling world there is nothing like waste, what you know and call waste can be converted to useable materials by recycling process.

Polythene and plastic materials have been proved to be non-biodegradable and they remain where they are dropped, thereby choking our soil, and suffocating our environment.

Furthermore, our poor refuse disposal habits gave room for “pure water” bags and other plastic products to be dumped just anywhere. These accounts for much of the blockage in gutters which in turn causes flooding that wash away our roads, pull down structures and cause other environmental problems.

There are three processes we can use to control polythene environmental pollution; reduction of use, re-use and re-cycling.

Waste polythene/plastic materials could be transformed into useful raw materials and such waste include pure water sachets, black, white or colored polythene used in wrapping brand new electronic like computers, television set, cellophanes or pharmaceutical drugs, nylon bags etc are all converted as raw materials for production of other goods like dunlop slippers, plastics head tanks, nylons, plastic jerry can, plastic plate or bowls etc.

This study estimates the composition of polythene waste in the waste generated and collected in the Ramat Polytechnic Maiduguri.

MATERIALS AND METHODS

Study area

The Ramat polytechnic Maiduguri campus constitutes the study area. The polytechnic houses about 20,000 people; students, staff and business owners. Roads, streets, dumping bins and commercial activities are well paved and are easily accessible.

Data Collection

The procedures used in actualising the objectives of this study are outlined below:

- Data required were collected from a variety of literatures both qualitative and quantitative, and used to generate the required figures successfully
- The polytechnic specific data were obtained from various sources and collated as shown in **Error! Reference source not found.**below

Table 1: Ramat polytechnic specific data

S/N	DATA	USE OF DATA	SOURCE
1	Population	To assess the amount of waste generated	Academic planning unit/ Physical and planning unit
2	Population Growth Rate	To assess the quantity of waste that can be generated over a number of years	UNFPA Nigeria (2014)
3	Waste Generation per person	To estimate how much waste can be generated by a person per day	Babatunde *et al.* (2013)
4	MSW Properties	General properties of waste generated such as organic fraction of waste, carbon-nitrogen ratio and biodegradability of waste generated	Igoni *et al.* (2007)
5	Waste Collection	To estimate how much waste can be made available for processing	Ogwueleka (2009)

Data Analysis

Population and per capita waste generation were used to calculate the total waste generated per day, this was converted to waste generated per year.

$$Total\ Waste\ Generated\ per\ day(Tonnes/day) = Population\ (hd) \times Average\ per\ capita\ Waste\ Generation\ (kg/hd/day) \quad (1)$$

Per capita waste generation is 0.16 to 5.7kg per person per day, and has an average of 1.1kg/capita/day, this was according to calculations made by (World Bank Group, 2018).
The percentage quantity of total generated waste that can be collected was assumed to be 70%. This is because Mattocks (1984), states that design of a digester must be based on amount of waste actually collected and not on the total waste generated.

RESULTS

The waste generated per year was calculated using the population and the per capita waste generation figures. Only 70% of total waste generated is collected, thus yielding a total waste generation of 554.4 Tonnes/year of MSW.

The percentage composition of the waste is shown in table 2 below

Types of Material	Percentage(%)
Sand/ inert materials	18.0
Food remnants	4.0
Grass/ leaves/shrubs	10.0
Metals(Cans/ tins)	9.5
Polythene/Plastics	30.0
Bottles	11.0
Paper and Magazines	15.0
Ceramics	2.5

DISCUSSION

The study was able to predict 554.4 tonnes/year of MSW generated in the study area and of that figure polythene/plastic constitutes 166.32tonnes/year (i e 30%). This is due to the well-structured nature of the study area and placement of refuse bins; which gives easy access to most MSW sites. However, the discrepancy can be attributed to the samplings as not all the MSW could be accounted for in the study.

Beverages in cans and plastics as well as other disposable means are mostly used in the polytechnic. This explains the high amount of plastics, paper and magazines but low food remnants as mainly snacks are consumed.

CONCLUSION

The annual estimate of metal, mainly aluminum cans; obtained annually by the waste collectors; depicts truly the major activities of the population in the study area.

The study concludes as follows:

a) The study depicts the major activities of the population of the study area.
b) An important amount of reusable and recyclables could be obtained
c) MSW collection, material recovery and recycling are alternatives ways to fight poverty, and can contribute immensely towards social reinsertion of marginalized people.

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