UNIVERSITY OF EDUCATION, WINNEBA

ANALYSIS OF PLASTIC WASTE MANAGEMENT IN THE BOLGATANGA MUNICIPALITY

FREDERICK GARUGTOMI NAAB

8150140003

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DECLARATION

STUDENT'S DECLARATION

I Frederick Garugtomi Naab declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, it is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: ……...

Date: ……

SUPERVISOR'S DECLARATION

I, hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: Dr. Anthony Baabereyir

Signature: ……...

Date: ……

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DEDICATION

This work is dedicated to my Mother and my family especially my son Lebna and my two daughters: Mannyeya and Maaboh for their moral support and love.

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ABBREVIATIONS/ACRONYMS USED

AMA	:	Accra Metropolitan Assembly
BMA	:	Bolgatanga Municipal Assembly
CBD	:	Central Business District
CSIR	:	Council for Scientific and Industrial Research
DACF	:	District Assembly Common Fund
DESSAPs	:	District level Environmental Sanitation Strategies and Action Plans
EC	:	Electoral Commission
EHSD	:	Environmental Health and Sanitation Department
EPA	:	Environmental Protection Agency
ESICOME	:	Expanded Sanitation Inspection and Compliance Enforcement
ESP	:	Environmental Sanitation Policy
ESU	:	Environmental and Sanitation Unit
ESU/BMA	:	Environmental Sanitation Unit of Bolgatanga Municipal Assembly
GHG	:	Green House Gas
GSB	:	Ghana Standard Board
GSS	:	Ghana Statistical Service
GTB	:	Ghana Tourist Board
HDPE	:	High-Density Polyethylene
HIPS	:	High-Impact Polystyrene
IGF	:	Internally Generated Fund
IRI	:	Industrial Research Institute
KMA	:	Kumasi Metropolitan Assembly
LDPE	:	Low-Density Polyethylene
LI	:	Legislation Instrument
MCA	:	Millennium City Authority
MEST	:	Ministry of Environment, Science and Technology
MLGRD	:	Ministry of Local Government and Rural Development
MMDA	:	Metropolitan, Municipal and District Assemblies
MOH	:	Ministry of Health
MSW	:	Municipal Solid Waste
NEAP	:	National Environmental Action Plan
NGOs	:	Non-Governmental Organizations
NESP	:	National Environmental Sanitation Policy
NESPoCC	:	National Environmental Policy Co-ordination Council
NRWM	:	National Report for Waste Management
PA	:	Polyamide
PC	:	Polycarbonate
PE	:	Polyethylene
PET	:	Polyethylene Terephthalate
PP	:	Polypropylene
PPP	:	Public Private Partnership

PPVC	:	Plasticized Polyvinyl Chloride
PS	:	Polystyrene
PU	:	Polyurethane
PVC	:	Polyvinyl Chloride
PWD	:	Public Work Department
SCPG	:	Sanitation Country Profile Ghana
TCP	:	Town and Country Planning
UERCC	:	Upper East Regional Co-ordination Council
UK	:	United Kingdom
UNDP	:	United Nations Development Plan
UNGCGN	:	United Nations Global Compact Ghana Network
USA	:	United States of America
WMD	:	Waste Management Department
ZL	:	ZoomLion

ABSTRACT

The study was "analysis of plastic waste management in the Bolgatanga Municipality". The objectives focused on plastic waste disposal practices, factors that accounted for poor plastic waste management, effects of poor plastic waste management and prospects for recycling plastic waste. The study employed a descriptive survey design through which all views were taken from residents, traders and staffs of waste management institutions. The researcher used participatory approach in order to have diverse views on the research topic. Other instruments used for the collection of the data were questionnaires, interviews, observations and still photographs. Notes and recordings were also considered. Views were sampled through a 16 item Likert - Type questionnaire from residents and traders and face-to-face interviews for residents, traders and staffs of waste management institutions. Also, data from documents on plastic waste management in the Bolgatanga Municipality were gathered for the study. Data was subjected to mean scores using themes and comments from questionnaires and interviews. The research recommended regular sensitization and education, adequate provision of skips, bins, tools, equipment, adequate funding, encouraging local entrepreneurs to go into plastic waste recycling and create conducive atmosphere to attract investors to invest in recycling schemes and factories. The study covers plastic waste management in the Bolgatanga Municipality only and so there is the need for further studies to cover other areas in order to cover categories of solid waste and in other Municipalities since plans are different; therefore the attitudes of the people may not be the same.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Wastes disposal was not a problem in the past as wastes were used as compost manure on farmlands for improved agriculture production (Mudgal & Lyons, 2011). According to Mudgal and Lyons (2011), wastes disposal became problematic in the towns and cities after plastic use became preferred to previously used materials. As the urban population rampantly keeps increasing on daily bases, the use of plastic also increases producing a lot of plastic waste in the towns and cities. The situation causes city authorities to seek for more resources and lands for plastic wastes and other waste disposal which are usually difficult to find.

However, Mudgal and Lyons (2011) asserted that, plastic products have brought benefits to society in terms of economic activity, jobs and quality of life. They added that, plastics can help reduce energy consumption and greenhouse gas emissions in many circumstances, even in some packaging applications when compared to the alternatives. However, with the increasing population, there has been corresponding increase in the use of plastic products worldwide where the wastes are mostly left to litter the environment.

Again, Mudgal and Lyons (2011) asserted that, plastic waste is generated from business activities at factories and other business-related establishments known as industrial waste and is also generated from households and business waste produced by restaurants and other business establishments called domestic waste.

Additionally, Yankson (1998) opined that, the plastic consumption is rising and with it, the amount of plastic ends up as waste. The report mentioned that, managing

plastic waste is a global problem with increasing amounts of waste in the developing countries and industrial nations. Fobil and Hogarh (n.d) added that, over the last few decades there has been a steady increase in the use of plastic products resulting in a proportionate rise in plastic waste in the Municipal Solid Waste (MSW) streams in large cities in Sub-Sahara Africa.

However, plastic waste is an important environmental health service all over the world. The way plastic waste is disposed off after using their content can cause environmental health problem in the society. Plastic waste when thrown indiscriminately, scatters all over the environment and sometimes finds its way in the drains, choke gutters and causes epidemic such as floods and diseases. Plastic waste in drains sometimes presents bad smell around the streets in the towns and cities. The sea is the most recipient to all sorts of plastic waste especially urban areas along the coast. This situation makes town and city authorities, government agencies, private organisations and individuals to spent most of their resources to solve the plastic waste problem in their various communities.

Zerbock (2003) cited by Puopiel (2010) asserted that, the collection of waste particularly plastic waste is basically the responsibilities of the town and city authorities in both developed and developing countries all over the world. However, he stated that, the format varies from one urban area to another. According to him, unlike the developed countries, the developing countries use about 20% to 40% of their metropolitan's revenue for waste management. Ghana is not an exception to this situation so as the Bolgatanga Municipality.

Moreover, plastic waste management is one of the major environmental problems facing Ghana today as there are difficulties in managing solid waste in general. Many

town and city authorities devote significant amount of their resources to plastic waste management but the problem appears not to be abating. The frequent outbreaks of cholera cases across the country as well as the flooding in our country's cities give credence to the poor state of plastic waste management. The phenomenon has assumed an alarming rate in our urban communities such that most Metropolitan and Municipal Assemblies find it difficult to manage the growing volume of plastic waste generated.

A cursory observation and preliminary survey in the Bolgatanga Municipality indicated that though the plastic waste disposal situation is not as bad as in the country's Metropolitan areas, it needs urgent interventions to prevent it from going out of hand. The plastic waste disposal situation in the town reveals that:

1. The residents have poor attitude towards plastic waste management.
2. Plastic waste appears to be scattered all over and no effort is being made to deal with the problem.
3. There is no proper waste collection scheme to collect and manage plastic waste.
4. There are no recycling facilities to recycle plastic waste.
5. Plastic waste poses health risk to the environment including the lives of plants and animals.

1.2 Statement of the Problem

Bolgatanga Municipality, the focus of this study, observation around the town reveals an environment littered with plastic waste. This situation has attracted the attention of leaders in government, among environmentalists and the media, who have spoken, written and published articles, report, books among others about plastic waste in the

Bolgatanga and other towns in the country. For instance, The National Plastic Waste Management Programme, Ghana (2007) established plastic waste management pragramme with the agencies responsible for waste management as stakeholders and partnered by the media in Ghana. Again, Essien (2014) writes on plastic waste on a topic: Plastic Waste: A Gargantuan Environmental Problem for Ghana'. Again, Teye (2012) writes on plastic waste on a topic: Plastic waste management in Accra, Ghana. Also, Fobil and Hogarh (n.d) write on Plastic Waste on a topic: The Dilemmas of Plastic Wastes in a Developing Economy: Proposals for a Sustainable Management Approach for Ghana. These and many other are attempts aim at addressing the plastic waste problems in the urban areas of Ghana.

However, in spite of these attempts to create public awareness on the negative attitude towards plastic waste and the challenges on the environment as well as the efforts being made to address the issue by the Bolgatanga Municipal Assembly and private organisations, the situation appears not to be abating. It seems the country's environmental policies and laws are not being properly enforced by authorities in the Bolgatanga Municipal Assembly.

Preliminary observation on the situation in the Bolgatanga Municipality has shown that, the area frequently experiences floods during the raining season often leading to loss of properties and sometime lives. Also, the area presents bad smell especially when one walks closer to gutters and skips or bins full of wastes.

Further observation during the survey has shown that, most of the plastic waste found in the community's environment is burned (incineration) at dumpsites, collection points and closer to residents' homes. This attitude can lead to environmental problems such as air pollution through the smoke release from the burning of the

plastic waste. Plastic waste burning (incineration) can cause heating to the atmosphere which can affect the ozone layer and cause greenhouse effect.

Moreover, the plastic waste situation in the Municipality appears as if there are no proper practical measures being taken to deal with the problem. For instance, it appears there are no efforts by the authorities of Bolgatanaga Municipal Assembly and other agencies responsible for plastic wastes management to reduce plastic waste generated in the Municipality. It also seems that there are financial constrains by the Assembly to effectively manage plastic waste and wastes in general. Lastly, it appears there is lack of enforcement of the environmental laws by authorities of the Assembly.

Checks at the Bolgatanga Municipal Assembly (BMA) and the Upper East Regional Coordination Council (UERCC) indicated that, there are researches made on waste management in the Bolgatanga Municipality. For instance, Ampofo, Kumi and Ampadu (2015) have done research on a topic: Investigating Solid Waste Management in the Bolgatanga Municipality of the Upper East Region, Ghana. Preliminary survey has found that despite the immensity of the problem, the researcher could not find specific research on plastic waste management in the Municipality. For this reason, the researcher finds it necessary to conduct this research to fill the gap by researching into the plastic waste management problem to find solutions.

1.3 Purpose of the Study

The purpose of the study was to analysed plastic waste management in the Bolgatanga Municipality.

1.4 Research Objectives

The objectives of the study were to:

1. Describe plastic waste disposal practices in the Bolgatanga Municipality.
2. Examine factors that account for poor plastic waste management in the Bolgatanga Municipality.
3. Examine effects of poor plastic waste management in the Bolgatanga Municipality.
4. Explore prospects for recycling plastic waste in the Bolgatanga Municipality.

1.5 Research Questions

The following research questions served as guide for the study.

1. What are the plastic waste disposal practices in the Bolgatanga Municipality?
2. What are the factors that account for poor plastic waste management in the Bolgatanga Municipality?
3. What are the effects of poor plastic waste management in the Bolgatanga Municipality?
4. What are the prospects for recycling plastic waste in the Bolgatanga Municipality?

1.6 Significance of the Study

The study significantly served as reference point for Bolgatanga Municipal Assembly and all other waste management institutions in the Municipality as far as plastic waste management is concerned. The study gave the waste management institutions an in-depth understanding of the problems of plastic waste and the strategies to tackle the problems.

Additionally, the study contributed to existing body of knowledge on plastic waste management and would stimulate further researches in the Municipality and other Metropolitan, Municipal and District Assemblies. The study helped the researcher developed skills in research and the challenges involved in research works. Last but not least, the study served as a guide for people who might want to undertake further researches in related area.

1.7 Scope of the Study

The focus of the research work was analysis of plastic waste management in the Bolgatanga Municipality. The study was conducted in five (5) communities. The communities were selected using the simple random selection procedure.

Contextually, the statements of the communities were analysed under themes such as methods of plastic waste disposal practices, factors that account for poor plastic waste management, effects of poor plastic waste management and the prospects for recycling plastic waste in the Municipality. The communities' participation projects and programmes were examined. Also, issues on finance, equipment and machines used as well as available infrastructure were dealt with.

1.8 Delimitation

The study covered the Bolgatanga Municipality only. The study included five (5) communities which were selected based on sample random selection procedure and agencies responsible for plastic waste management in the Municipality. It dealt with the problems of plastic waste management in the Municipality.

1.9 Operational Definitions of Terms

Waste: Waste is any material that arises from human and animal activities that are normally discarded as useless and unwanted. Waste includes non-hazardous industrial, commercial and domestic waste such as household organic trash, street sweeping, institutional garbage and construction waste.

Plastic: Plastic is an extremely versatile synthetic material made from the polymerization of organic compounds. It can be moulded into shapes or fabricated in many different forms for use in commerce and industry.

Plastic Waste Management: This refers to the collection, transportation, treatment, final disposal and recycling of plastic waste.

Disposal of Plastic Waste: This refers to the final handling of plastic waste following collection, processing or incineration.

Enforcement: This refers to administrative or legal procedures and actions to require compliance with legislation, regulations and limitations.

Municipal/Domestic Waste: This refers to generally liquid and solid waste originating from a mixture of domestic (household), commercial and industrial sources.

Reuse: This is the application of appropriately treated materials for another purpose.

Waste Management Institutions: This refers to all Government agencies, private sectors and other stakeholders responsible for waste management.

1.10 Organisation of the Study Report

The study was organised into five chapters. Chapter one covered background to the study, statement of the problem, purpose of the study, objective of the study, research questions, significance of the study, scope of the study, delimitations of the study,

definitions of terms and organization of the study. Chapter two focused on the review of related literature to the study. Chapter three discussed the methodology pivoted around design of the study, the study area, sample procedure, population, sample and sampling techniques, instruments for data collection, reliability and validity of the instrument, data collection procedure, presentation and analysis and ethical issues. Chapter four presented and analysed the results. Chapter five outlined the summary of the findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter explored the relevant literature on the topic under study. It provided introduction, definition of concepts, plastic waste disposal practices in developing countries, factors that account for poor plastic waste management in developing countries, effects of poor plastic waste management in developing countries, prospects for recycling plastic waste in developing countries and summary.

2.1 Definition of Concepts

This section is the literature review of people who have written in areas concerning plastic waste. It looked at waste in general, plastic waste, types of plastic waste, sources of plastic waste and waste management.

2.1.1 Waste

According to Gourlay (1992) cited by Freduah (2004), waste is more easily recognized than defined. According to him, something can become waste when it is no longer useful to the owner or it is used and fails to fulfill its purpose. He argued that, there are basically two types of waste namely liquid waste and solid waste.

Gilpin (1976) cited by Uchegbu (1998) defines waste as materials of solid or semi-solid character that the possessor no longer considers of sufficient value to retain Galagher (2000) defines waste as any material where the holder has an intention to discard the material as no longer part of the normal commercial cycle or chain of utility. Wokekoro (2007) opined that, waste can be any garbage, sludge, gaseous and other discharged materials resulting from various community activities. He explained that, waste consists therefore of discarded materials resulting from domestic and

community activities and from industrial, commercial and agricultural operation. He again stated that, waste can be referred to as any unwanted material that is discarded as something not needed.

Mwayafu (2010) asserted that, waste is a man-made substance in a given time and places which in actual structure and state is not useful to the owner and/or is an output without an owner and purpose. He mentioned that, waste may be in solid or liquid states. According to him, waste includes all items that people no longer have any use for, which they either intend to get rid off or have already discarded. He further mentioned that, wastes are such items which people required to discarding. He stated that, many items can be considered as waste for example, household rubbish, sewage sludge, wastes from manufacturing activities, packaging items, discarded cars, old televisions, garden waste, old paint containers etc. Thus all our daily activities can give rise to a large variety of different wastes arising from different sources. He noted that, solid wastes refer to particles or materials which are no longer useful to their owners.

2.1.2 Plastic Waste

Mudgal and Lyons (2011) defines plastic waste as any plastic material which comes from domestic, commercial and industrial sources arising from human activities and has no value to people and which is discarded as unwanted. Fobil and Hogarh (n.d) asserted that, plastic waste is any unwanted plastic that is dumped in an area with the expectation of not using it again.

2.1.3 Types of Plastic Waste

The types of plastic waste generated vary from place to place. Wienaah (2007) asserted that, in industrialized countries, literally hundreds of plastic materials are

available commercially. Again he stated that, in economically less developed countries however, fewer types of plastics tend to be used. However, he added that, in both economically less developed and industrialized countries, the four types of plastics that are most commonly reprocessed or recycled are polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyvinyl chloride (PVC). Each of these can be subdivided according to their density, the type of process involved in their manufacture, and the additives they contain. However, these plastics become waste and are discarded into the solid waste stream after using their content.

2.1.4 Sources of Plastic Waste

Ampofo (n.d) argued that, the sources of plastic waste in Ghana and many other developing countries are classified into three forms: industrial waste, commercial waste and municipal waste. According to him, industrial plastic wastes are obtained from the plastics packaging industries. He stated that, many industries discard polyethylene film wrappers that has been used to protect goods delivered to the factory. He added that, the polyethylene film wrapper is an excellent material for reprocessing, because it is usually relatively thick, free from impurities and in ample supply. He again stated that, commercial plastic waste is basically generated from workshops, craftsmen, shops, supermarkets and wholesalers which may be able to provide reasonable quantities of plastic waste for recovery. According to him, a great deal of such waste is likely to be in the form of packaging material made of polyethylene (PE), either clean or contaminated. He gave examples as Hotels and restaurants with often sources of contaminated polyethylene (PE) material.

Additionally, Ampofo (n.d) argued that, the third source of plastic waste is municipal established. According to him, this source of plastic waste generated or collected from

residential areas is domestic or household waste from streets, parks, collection depots and waste dumps. He stated that, in Ghana for instance, considerable amounts of plastic waste can be found within the Municipal Solid Waste (MSW) stream due to the littering habit of the people. According to him, the most common type of plastic waste within the municipal waste stream is the 'sachet' water film bags that are discarded indiscriminately soon after consuming its contents. He opined that, unless there is an effective way of collecting this plastic waste such as buying them directly from the household, before they are mixed with other waste materials, such plastic waste is likely to be dirty and contaminated.

Ampofo (n.d) further asserted that, sometimes, when the plastic wastes are mixed with other solid waste in the solid waste stream, the plastic waste is separated and cleaned, but contamination with hazardous waste is not always visible and may be more difficult to remove. He stated that, liter that has been waiting for collection for some time may have been degraded by sunlight. According to him, this is mainly a superficial effect and does have influence on the quality of the plastic waste meant for reprocessing or recycling.

Ehrig (1992) cited by Ampofo (n.d) asserted that, the sources of plastic waste generated in Ghana is basically grouped into primary waste and secondary waste. The primary wastes are mostly generated from plastic producing and goods manufacturing industries. He mentioned that, a characteristic of primary waste is that, the quality of plastics recovered for reprocessing is almost as high as that of virgin plastics. According to him, the waste is pure and suitable for reprocessing with standard equipment into the same kind of products manufactured from virgin materials. He again stated that, the processing of primary waste into products with characteristics

similar to those of the original products is called primary recycling. According to him, primary plastic waste is usually homogeneous and therefore its recycling is comparatively economical and easier.

Ehrig (1992) cited by Ampofo (n. d) asserted that, the term 'secondary waste' refers to plastic waste from sources other than the industrial ones. He noted that, the secondary source of plastic waste is predominant in Ghana, due to the consumption and littering habits of the inhabitants. According to him, these plastic waste is impure, that is, it may be contaminated and often consist of mixtures of various types of plastics according. He added that, the direct reprocessing of such mixed plastic supplies is called secondary recycling and results in products with poor mechanical properties because of the different characteristics of the plastics they contain. He mentioned that, the potential for marketing these materials is relatively low.

2.1.5 Waste Management

The term 'waste management' has been viewed differently by various authors. Kumah *(2007: 2)* defines solid waste management as "the administration of activities that provide for the collection, source separation, transfer, processing, treatment and disposal of waste. Tchnobanoglous et al.*(1993: 7)* defined waste management as "the discipline associated with the control of generation, storage, collection, transfer and transport processing and disposal of waste in a manner that is in accord with the best principles of public health, economic, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes".

The Mindful Word Report (2016) stated that, incineration and landfills are the most widely-used waste management methods. According to the report, from small-scale to municipal-industrial units, incineration is the burning of garbage and is favoured by

small countries that lack adequate landfill space. The report stated that, incineration can however, have a major impact on the environment. Burning plastics and other types of waste release toxic gases into the atmosphere, contributing to the greenhouse effect. The report mentioned that, most hazardous waste, especially biomedical, is destroyed by incineration to prevent contamination and the spread of disease.

Isirimah (2002) asserted that, the problems associated with the management of solid wastes particularly plastic in today's society are complex because of the quantity and diverse nature of the wastes, the development of urban areas, the funding limitations for public services in many large cities, the impacts of technology and resulting limitations in both energy and raw materials. He stated that, the activities associated with management of solid wastes from the point of generation to final disposal have been grouped into six functional elements: Waste generation; Waste handling; Storage; processing at the source; Waste collection and Separation.

The World Bank Report (2017) stated that, when one asks a city mayor of a developing country about his or her most pressing problems, solid waste (plastic) management generally will be high on the list. The report stated that, for many cities, solid waste management is their single largest budget item and largest employer. The report noted that, waste management is also a critical matter of public health, environmental quality, quality of life and economic development. According to the report, a city that cannot effectively manage its waste is rarely able to manage more complex services such as health, education or transportation. No one wants to live in a city surrounded by garbage. The report further mentioned that, as the world urbanizes, the situation is becoming more acute. More people mean more garbage, especially in fast-growing cities where the bulk of waste is generated.

Hoornweg and Bhada-Tata (2012) opined that, solid waste management is one service that most city governments provide for their residents. They mentioned that, while service levels, environmental impacts and costs vary dramatically across, solid waste management is arguably the most important municipal service and serves as a prerequisite for other municipal action. Again, Siddiqui and Pandey (2013) argued that, the solution to the waste management problem lies in segregation of dry and wet solid waste at the source for which an effective mass awareness campaign is very important. They noted that, creation of efficient solid waste management infrastructure coupled with encouraging establishment of recycling centers would help address the Mixed Solid Waste (MSW) and more especially plastic waste problems. They further mentioned that, plastics can be recycled to produce articles for mass use augmenting the concept of resource management. They also mentioned that, many useful products have been developed with recycled plastics and a large number of people are employed in these activities in small, micro and informal sectors.

Pulitzer (2013) asserted that, the Ghanaian government handed over most of the country's waste management to private companies through its Public Private Partnership (PPP) policy. Since then, according to the report, waste collection has been in the hands of the private sector although the various Metropolitans, Municipal and District Assemblies take part in waste collection and management. An example of such private waste collection and management agency is ZoomLion Ghana Limited. The report stated that, private waste management employees are only required to clean the main gutters and rid streets of trash.

Additionally, Pulitzer (2013) added that, the re-use market also exists in Ghana. For instance, glass and plastic bottles are collected and often used to store fluids like palm

oil that are made at home and then sold in the market places. At the same time that recycling and composting are touted as the future of Ghana's waste management. According to the report, many years ago, almost all Ghanaians used to collect their waste, take it to a remote location on the outskirts of town and burn it. This has changed somewhat since the government introduced waste management services in conjunction with private companies. It noted that, now, waste particularly plastic in cities and towns are usually put in landfills. Waste in villages and rural areas; however, is still burned although villagers are aware that burning waste leads to health complications.

The Ministry of Local Government and Rural Development (MLGRD, 2004; cited by Puopiel, 2010) asserted that, general waste management in Ghana is the responsibility of the MLGRD which supervises the decentralised Metropolitan, Municipal and District Assemblies (MMDAs). However, the document pointed out that, regulatory authority is vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science, the Metropolitan, Municipal and District Assemblies are responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and the Environmental Health and Sanitation Departments (EHSD).

Drawing from the views given by the Sanitation Country Profile Ghana (SCPG) and the National Report for Waste Management (NRWM) in Ghana, it can be said with certainty that MMDAs are the primary authorities to manage solid waste at the local level. Based on the above statements, it is clear that, waste particularly plastic management is a difficult challenge for most urban authorities and this needs

immediate attention to find remedy to the problem in order to prevent it from escalation.

2.2 Plastic Waste Disposal Practices in Developing Countries

This section sought and described plastic waste disposal practices in the developing countries. It dealt on the themes such as plastic waste disposal in open spaces, plastic waste disposal in drains and plastic waste disposal in water bodies.

2.2.1 Plastic Waste Disposal in Open Spaces

Disposing of waste, particularly plastic, has huge environmental impacts and can cause serious problems. The Green Choice Report (2017) stated that, much of the waste particularly plastic is buried in landfill sites (holes) in the ground, sometimes old quarries, sometimes specially dug. The report noted that, some waste will eventually rot, but not all, and in the process it may smell or generate methane gas, which is explosive and contributes to the greenhouse effect. It added that, leachate produced waste which decomposes may cause pollution. Again. It added that, badly-managed landfill sites may attract vermin or cause litter.

Cointreaun (1982); UNEP-IETC (1996) asserted that, generally, one to two thirds of the municipal solid wastes particularly plastic generated in the cities of the developing countries is not collected. As a result, the uncollected waste, which is often also mixed with human and animal excreta, is dumped indiscriminately along the streets and in drains, so contributing to flooding, breeding of insect and rodent vectors and the spread of diseases.

Siddiqui and Pandey (2013) argued that, plastic bottles and sachets have become prevalent all over developing countries, particularly, urban areas. According to them,

the packaging revolt has not been backed by proper plastic waste management policy, which has left a lot of cities littered with plastic wastes, hence, creating horrible visual troubles and other community health problems.

Furthermore, Essien (2014) asserted that, plastic waste, and for that matter, plastic pollution involves the accumulation of plastic products in the environment that adversely affects humans, wildlife and wildlife habitat. According to him, plastic pollution occurs in many forms, including, but not limited to littering which is the major problem in Ghana and many other developing countries. He further noted that, plastic usage is expected to increase and this pollutant particularly from sachet water and kenkey wrapping is not biodegradable. He mentioned that, it is estimated that the decomposition of such plastics takes about 400 years. Again, he explained that, no one will live so long to witness decomposition of plastics. Thus, we should start plans to save the environment for future generations of humans as well as animals.

Additionally, Chandak and Pazare (2015) argued that, modern lifestyle, alongside the advancement of technology has led to an increase in the plastic waste being generated, leading to a waste disposal crisis. They mentioned that, more than 90% of the articles found on the sea beaches contain plastic. They again stated that, plastic waste is often the most objectionable kind of litter and will be visible for months in landfill sites without degrading.

2.2.2 Plastic Waste Disposal in Drains

Essien (2014) opined that, in Ghana, the immediate threat is with our landfill sites and our drainage system. According to him, landfill sites are for organised disposal of waste materials and non-biodegradable materials such as plastics tend to artificially clog such sites. He stated that, it is worth noting that these landfill sites are not

inexhaustible. Again, he noted that, clogging our poorly maintained drainage system (opened filthy gutters, bequeathed us by the colonialists, which have not seen any major improvements yet) is the result of plastic pollution. He mentioned whether people are not concerned about the perennial flooding in major cities and towns in Ghana because of poor and clogged drainage system or whether people are not concerned about the creation of breeding places for mosquitoes. He also stated that, about 85% of the solid waste dredged from choking gutters around the market circles was made of plastic from sachet water.

2.2.3 Plastic Waste Disposal in Water Bodies

Some concerns have been that our beaches and other water bodies have been inundated with sachet water waste destroying their aesthetic beauty thereby driving away tourists (News Ghana, 2012). Gianna (2016) argued that, as far as plastic is entering the ocean, about 20% of the trash comes from ships and platforms that are offshore. According to him, the rest sources from litter being blown into the sea, picked up by tides on the beach, or intentional garbage is dumping. He explained that, the worst part is that, these plastics do not biodegrade, so they break up into tiny pieces that are consumed by fish and sea mammals. According to him, plastic is killing more than 100,000 sea turtles and birds a year from ingestion and entanglement. He stated that, chemicals in plastics are released into the water as well as the atmosphere. He again noted that, fish easily become contaminated from the chemicals in the water and this is a direct link of how plastic chemicals enter the food chain.

Moreover, Gvern (2017) asserted that, on shore, the spectacle becomes even more poignant, as thousands of bird corpses rest on these beaches, piles of colourful plastic

remaining where their stomachs had been. According to him, witnesses have watched in horror seabirds choosing plastic pieces, red, pink, brown and blue, because of their similarity to their own food. It is estimated that 1.5 million Laysan Albatrosses which inhabit midway, all of them have plastic in their digestive system.

2.3 Factors that Account for Poor Plastic Waste Management in Developing Countries

This section sought and explored the factors that account for poor plastic waste management in the developing countries. It dealt excessively on the themes such as lack of dumping sites for plastic waste disposal; ignorance on plastic waste management; poverty contributes to plastic waste management and non enforcement of environmental laws.

2.3.1 Lack of Dumping Sites for Plastic Waste Disposal

The Angelfire Report (n.d) stated that, one of the factors of poor domestic waste management in developing countries is lack of dumping sites (where to deposit the waste particularly plastic). The report mentioned that, the lack of dumping sites came as a result of the fact that, waste management is new in the developing countries. It stated that, waste was not considered to be a problem before until recently when plastic waste has emerged as the most considerable problem in the developing countries. Kulich (2013) argued that, lack of dumpsites have made people dumped their waste on the road side which formed dangerous material left for someone else to clean up and dispose off appropriately, placing locals and those along the dumping sites at risk of inhaling fibers that can cause serious health problems later in life.

Additionally, Hanifa (2013) opined that, one of the key factors for the increased improper plastic waste disposal within the cities and towns is insufficient space to store recyclable plastic waste, particularly in impoverished urban areas like slums.

2.3.2 Ignorance on Plastic Waste Management

The Angelfire Report (n.d) further opined that, ignorance of the masses about the need to dispose off wastes well and how to dispose off them (the wastes) is one other cause. The Report noted that, lack of enough literacy programmes on plastic waste management, leaves most of the people backward on waste management. The report indicated that, ignorance on plastic waste management is caused by poor or lack of sensitization of the masses by the government and other organisations.

Kizza (2010) asserted that, over the years, Kampala city as in many other cities has been synonymous with poor waste disposal. According to him, there is prevalence of haphazard dumping of waste particularly plastic everywhere in the city that one would easily think that the authorities are not doing much to solve the problem. He stated that, city authorities are responsible for collecting garbage and proper management of waste. However, it is common to see heaps of garbage along streets and pathways in Uganda's capital city as in other cities in the developing world and as a result people's health has been at a far greater risk than ever.

2.3.3 Poverty Contributed to Plastic Waste Management

The Angelfire Report (n.d) argued that, undoubtedly, poverty leads to masses buying cheap non bio-degradable containers which are not easy to dispose off, and also substitutes like paper bags are not easily available to the rural poor communities. The report noted that, the low expense of these solid wastes especially polythene bags and

other plastics which are very cheap as compared to other containers makes them very common, which makes their proper disposal very difficult.

Moreover, the Practical Action Report (2017) stated that, urbanization in Nepal and other cities in developing countries are increasing at an alarming rate. It indicated that, due to lack of appropriate employment opportunities, a large number of workers in the informal economy are engaged in waste related work. It again noted that, although these workers play a vital role in dealing with the waste generated, the profession is considered shameful and degrading, and its contribution is unrecognised by society as well as local and state authorities.

Furthermore, the report revealed that, urban waste pickers are among the poorest people in towns and cities of the developing world. It indicated that, most live in squatter settlements are exposed to many health risks through unprotected handling of waste materials due to their poor living conditions. According to the report, the plastic waste picking profession is despised by the rest of society, despite its contribution to removing and recycling large quantities of plastic waste. Again, the report stated that, plastic waste workers are often exploited socially and economically and they find it hard to fight this exploitation due to a range of factors including their lack of bargaining power, illiteracy, lack of market information and lack of skills and technology which could help them add value to the materials they collect and recycle.

2.3.4 Non Enforcement of Environmental Laws on Plastic Waste Management

The Wikimedia Foundation (2017) stated that, waste management laws are governed by the transport, treatment, storage, and disposal of all manner of waste, including municipal solid waste, plastic waste, hazardous waste, and nuclear waste, among many other types. According to the foundation, waste laws are generally designed to

minimize or eliminate the uncontrolled disposal of waste materials into the environment in a manner that may cause ecological or biological harm, and include laws designed to reduce the generation of waste and promote or mandate waste recycling. Regulatory efforts include identifying and categorizing waste types and mandating transport, treatment, storage, and disposal practices.

According to Volokh and Marzulla (1996), the current enforcement of environmental laws often violates basic principles of fairness, with perverse consequences for everyone. They indicated that, businesses suffer from the high costs of attempting to comply with vague and ambiguous environmental regulations to avoid prosecution. Again, they stated that, individuals suffer by being subject to civil and criminal penalties unjustly imposed, and out of proportion to the severity of their violations. Also, Government suffers by failing to improve the environment, while spending vast sums of money on sometimes useless litigation efforts. According to them, we all suffer by having dirtier water, more polluted air and a less clean environment than we should have for the tremendous sums we spend.

Furthermore, Volokh and Marzulla (1996) asserted that, environmental enforcement encompasses the range of measures which government uses to punish non compliance with environmental laws or regulations. They mentioned that, when faced with a violation of environmental laws, enforcement agencies can often choose from a range of options from administrative action to civil fines to criminal prosecution.

Moreover, Chennai (2012) asserted that, the amount of waste taken out of the drains is simply unimaginable and the task of disposing it is another mammoth challenge indeed. He stated that, when commercial establishments indulge in indiscriminate dumping of waste in public places or drains, the violators can at least be easily identified and penal action, including collection of fine, could be initiated. He noted

that, in the case of individuals throwing waste into the storm water drains, there is no way the local body administration can act against them. He further noted that, Environmentalists blame the State Government for soft-pedaling on the issue of using plastics and polythene.

Based on the information stated, it is an indication that lack of dumping sites, ignorance, poverty and non enforcement of environmental laws are the major factors that account for poor plastic waste management in the developing countries.

2.4 Effects of Poor Plastic Waste Management in Developing Countries

This section sought and examined the effects of poor plastic waste management in the developing countries. It will dwell more on the themes as plastic waste spread diseases, plastic waste causes flood, plastic waste causes air pollution, plastic waste causes water pollution and plastic waste littering degrades the land.

2.4.1 Plastic Waste Spread Diseases

The improper plastic waste disposal leads to increasing sanitation issues, damage to the environment and blocked drains, which contributes to stagnant water accumulation and negative health effects such as malaria caused by the breeding of mosquitoes in unsanitary conditions (UNDP Ghana, 2017). News Ghana (2012) presented that, choked gutters with plastic waste also become fertile breeding grounds for mosquitoes infesting the general populace with malaria.

Again, Mudgal and Lyons (2011) opined that, plastic waste imposes negative environmental externalities. They added that, plastic waste poses risks to human health as well as the environment.

In another development, the eSchooltoday Report (2015) stated that, the plastic waste when improperly dumped into the atmosphere can lead to the destruction of the ozone layer and may cause diseases such as cancer and as a result of the problem cause global warming. Also, the Angelfire Report (n.d) noted that, the improper dumping can lead to death of fish and diseases to human, examples of such diseases are dysentery, cholera and typhoid. On his side, Hanifa (2013) asserted that, bad waste management practices can result in land and air pollution and can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body.

2.4.2 Plastic Waste Causes Floods

The Angelfire Report (n.d) indicated that, when plastic wastes are dumped in drainage channels and gutters, it blocks the flow of the sewerage and this may cause flooding and at the same time, it affects soil drainage which hinders the growing of crops.

Additionally, Ampofo (n.d) asserted that, the wastes especially plastic choke the drainage systems in the urban centers in Ghana to such an extent that it takes only the slightest of rainfall to precipitate floods in major cities and towns. He argued that, although different factors such as erection of buildings and structures in water courses have contributed to increased incidence of flooding, lately, the significant cause of flooding in the cities in Ghana is linked to the tremendous deterioration in urban drainage systems; most of which is attributable to plastic wastes blocking the drainage systems. News Ghana (2012) also indicated that, the worry of all these governments is the fact that our gutters get choked with plastic waste leading to flooding in most parts of the city after the rains.

2.4.3 Plastic Waste Causes Air Pollution

Hanifa (2013) argued that, burning waste particularly plastic on the disposal sites can cause major air pollution, affect climate change by increasing Green House Gas (GHG) emissions, and this has effect on human health by causing illness (respiratory diseases) and the risk of fire can spread to the adjacent properties, and make disposal sites dangerous.

Furthermore, the Green Choice Report (2017) stated that, incinerating waste causes problems, because plastics tend to produce toxic substances, such as dioxins, when they are burnt. The report noted that, gases from incineration may cause air pollution and contribute to acid rain. Again, the ash from incinerators may contain heavy metals and other toxins. According to the eSchooltoday Report (2015), bad plastic waste management practices can result in land and air pollution and can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body. Also, the Angelfire Report (n.d) noted that, air pollution can lead to formation of acidic rain which is dangerous to crop life since it fastens the removal of soil fertility from the surface of the ground. It again stated that, some of these wastes especially plastic burning can be very harmful to the atmosphere.

2.4.4 Plastic Waste Causes Water Pollution

Hanifa (2013) opined that, waste particularly plastic that end up in water bodies negatively change the chemical composition of the water. He argued that, technically, this is called water pollution and it affects all ecosystems existing in the water. According to him, it can also cause harm to animals that drink from such polluted water. Hanifa (2013); eSchooltoday Report (2015) noted that, leachate forms very

harmful mixture of chemicals that may result in hazardous substances entering surface water, groundwater or soil. According to Hanifa, polluted water flowing from waste dumps and disposal sites can cause serious pollution for the surface water and the surrounding environment.

Moreover, the eSchooltoday Report (2015) stated that, water pollution will affect all ecosystems existing in the water and can also cause harm to animals that drink from such polluted water. The Angelfire Report (n.d.) asserted that, solid wastes particularly plastic, when improperly disposed especially in water can have an environmental hazard in the surrounding environment and the fish in that environment can be affected. Mudgal and Lyons (2011) further argued that, fish and other aquatic animals found in polluted water bodies swallow the plastic garbage mistaken as food items and die.

2.4.5 Plastic Waste Littering Degrades the Land

Hanifa (2013) opined that, poor waste management particularly plastic can be as a result of uncollected wastes placed on the ground, which can result in unsanitary conditions especially during the rainy season. He indicated that, flies and mosquitoes breed in some constituents of wastes particularly plastic waste. He further stated that, a city with poor sanitation, smelly and with waste matter all over the place does not attract good people, investors and tourists. According to Ampofo (n.d), some of the problems of plastic waste are ice-water and ice-cream wrappers, black polyethylene film bags and other plastic materials resulted from plastic waste thrown away indiscriminately after using their content.

Mudgal and Lyons (2011) asserted that, plastic waste disposal situation creates environmental problems in developing countries such as Ghana due to lack of proper

disposal practices. According to them, the 'throw away culture' by the public after using plastic products result in polyethylene film bags being scattered all over the towns and cities' drainage systems and thus choking the drains. Again, the UNDP Ghana Report (2017) mentioned that, due to increased urbanization and changing lifestyles, there is a considerable amount of waste especially plastic waste generated in towns and cities which has led to indiscriminate littering in their surroundings. The report stated that, empty plastic water bottles and other plastic waste in particular is a major nuisance and can be seen on the streets and in gutters across the city.

To add to, the Angelfire Report (n.d) indicated that, the uncontrolled dumping of plastic waste leads to wastage of land where we find lots of land being used as dumping sites for wastes. It noted that, the same pieces of land are later on neglected by the inhabitants of the area as a result of littering. The report mentioned that, poor waste management can be a source of under development around the society's surroundings and the situation can cause harm to tourist industries of the particular countries.

Furthermore, Mudgal and Lyons (2011) opined that, littering of the land with plastic bags and materials presents ugly and unhygienic scene in the urban communities of the country. They indicated that, the indiscriminate littering reduces the rate of rain water percolating resulting in lower level of the water table. They further stated that, plastic waste left uncollected find their way into water bodies polluting them and when animals eat plastics, sometimes die. They asserted that, plastics become a nuisance because of their non-biodegradability. According to them, oil fertility deteriorates as plastic bags form part of manure and remain in soil for years. They again argued that, plastic waste degrades farmlands use for the cultivation of crops

which leads to poor yield in agriculture products. They indicated that, the hazardous effect of improper treatment of plastic waste causes environmental problems such as air and water pollution as well as land degradation, which increase greenhouse gas emissions into the atmosphere leading to greenhouse effect.

2.5 Prospects for Recycling Plastic Waste in Developing Countries

This section explored the prospects for recycling plastic waste in developing countries. It dealt on the volume of plastic waste generated, types of plastic waste generated, willingness to participate in plastic waste schemes and prospects for establishment of plastic waste recycling factories.

2.5.1 Volume of Plastic Waste Generated

Chaerul (2013) asserted that, economic growth, changing consumption and production patterns are resulting in rapid increase in the generation of plastic wastes, including plastic packaging waste (PPW). According to him, a variety of PPW is identified in the municipal solid waste (MSW) stream. For instance, food remains (38%) and plastics (37%) formed the biggest proportion of wastes generated in households. He noted that, most households (35.9%) disposed off general wastes by open dumping while 27% disposed off plastics by burning. He noted that, though the generation rate per capita is not so high (25.1 g per day), total PPW generated by 2.3 million inhabitants in Bandung becomes 58.4 tonnes per day (3.76 % of total MSW generated). He mentioned that, due to lack of integrated MSW management, most of PPW is neither collected properly nor disposed of in appropriate manner by the municipality. He further noted that, collection of valuable wastes including PPW is done predominantly by the informal sector without regard to health and safety. He predicted that, total PPW recycled by various informal waste recycling players like

scavengers, junkmen, intermediates and dealers is 27.5 tonnes per day (64.6 % of total PPW generated).

Again, Rodger (2016) provides a new global fact base about plastic packaging. It is: the biggest (78 metric tonnes per year), most waste-prone (40% land filled + 32% not collected at all) segment of plastics, growing at 5% per year. According to him, overwhelmingly linear 90% of plastic is used once then becomes waste. He indicated that, it is not news that plastic is clever stuff but creates lots of waste. He noted that, some attack advocating banning plastic whereas, some say burn it then it won't go into the oceans (moving the problem to the air). He mentioned that, some artisans have been turning tiny amounts of plastic into trendy durable stuff.

Furthermore, Zhu (2007) asserted that, as one of the most fast developing industries in China, the plastic industry maintains a growth rate of more than 10% per year. The output of plastics in China reached 26.8 metric tonnes in 2003 (Liao, 2004; cited by Zhu, 2007). In comparison with developed countries in terms of average consumption, it can be seen that the quantity is less in China (Zhu, 2007). According to Zhu (2007), the uses of plastic waste have been dramatically increasing from 1996 to 2005. He mentioned that, there are many collection points being distributed in the cities and countries. According to the survey of the Committee of Economy and Trade of China, the recycling output of the plastic wastes in China was up to 6 metric tonnes in 2005 (Tan 2006).

Ji et al. (2000) asserted that, comparatively, it can be found that the quantity of plastic wastes in China is still less than that of plastic consumption, and the proportion of recycling plastic wastes merely reaches one-fifth of the consumption. Zhu (2007) stated that, the post consumer recycled polyvinyl chloride (PVC) is less than other

category of plastic wastes in China. He noted that, the recycled plastic wastes account for 0.4 – 1.5% of Municipal Solid Waste in China (only 0.14 metric tonnes per year at Beijing).

Moreover, the Practical Action Report (n.d.) argued that, waste generation including plastic in sub-Saharan Africa is approximately 62 million tonnes per year. The report indicated that, per capita waste generation is generally low in developing countries, but spans a wide range, from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day. The report further mentioned that, countries with the highest per capita rates of waste particularly plastic generated are islands, likely due to the tourism industry, and a more complete accounting of all wastes generated. The above information indicates that, though the volume of plastic waste generated in the developing countries is generally low, it is expected to increase at a faster rate considering the volume of plastic waste generated on daily bases.

2.5.2 Types of Plastic Waste Generated

Zafar (2013) asserted that, apart from familiar applications like recycling bottles and industrial packaging film, there are also new developments for example, the recovery initiative of the PVC industry (covering pipes, window frames, roofing membranes and flooring). Again, the IV- Environment-E-Plastic recycling report (2007) revealed that, plastics for recycling are collected from two main sources. The report indicated that, there are post consumer plastics and post industrial plastics. According to the report, post consumer plastics are those which have already been used by people and there are plastics collected in plastics recycling bins and at domestic roadside collections. It stated that, the post industrial plastics are rejects from industry such as off-cuts and damaged batteries. Plastics collected either directly from the industry or

collected by the local council, are squashed into bales and sold to a recycler (Siddiqui & Pandey, 2013).

Furthermore, Zafar (2013) indicated that, Polyethylene terephthalate (PET) and high density polyethylene (HDPE) bottles have proven to have high recyclability and are taken by most curbside and drop-off recycling programs. He noted that, the growth of bottle recycling has been facilitated by the development of processing technologies that increase product purities and reduce operational costs. He again stated that, recycled polyethylene terephthalate (PET) and high density polyethylene (HDPE) have many uses and well-established markets. In contrast, he mentioned that, recycling of polyvinyl chloride (PVC) bottles and other materials are limited. He further argued that, a major problem in the recycling of polyvinyl chloride (PVC) is the high chlorine content in raw polyvinyl chloride (PVC) (around 56% of the polymer's weight) and the high levels of hazardous additives added to the polymer to achieve the desired material quality. As a result, PVC requires separation from other plastics before mechanical recycling.

However, Siddiqui and Pandey (2013) opined that, some types of plastic waste like multi layer laminates are not easily recyclable by conventional process. They argued that, sometimes when different types of plastic waste, which are otherwise easily recyclable individually, get mixed with different groups of plastics in the waste stream forming, comingled plastic waste, recycling becomes difficult. According to them, such type of plastic waste, generally, is abandoned by the waste pickers creating waste management problem.

Moreover, Zafar (2013) argued that, recycling and reuse of plastics is gaining importance as there is a sustainable method for plastic waste disposal. Again, he

stated that, plastic is much more difficult to recycle than materials like glass, aluminum or paper. He argued that, a common problem with recycling plastics is that plastics are often made up of more than one kind of polymer or there may be some sort of fiber added to the plastic (a composite). Also he indicated that, plastic polymers require greater processing to be recycled as each type melts at different temperatures and has different properties, so careful separation is necessary.

2.5.3 Willingness to Participate in Plastic Waste Recycling Schemes

According to Thomas (2001), diversion of waste (plastic) to recycling will depend not only on the number of people who participate, but on how well they do so and how effectively they participate. Spencer (1994) and Thomas (2001) agree that it is difficult to measure quantitatively the performance of recycling programmes on a consistent and standard base. However, they asserted that, there are four useful performance measures which have been defined as: capture rate; participation rate; recycling rate and diversion rate. They opined that, capture rate is the weight or percentage of some eligible material (plastic) in the total refuse stream actually separated out for recycling. Participation rate denotes the percentage of households (or businesses) which regularly setout recyclables. Recycling rate is used to indicate the quantity of recyclables collected per household per unit of time and diversion rate represents the weight of total refuse (plastic) that is not landfilled (or not incinerated).

Makau (2005) asserted that, in domestic waste (plastic) recycling programme, success is likely to be gauged by participation rates and recycling rates. According to him, high participation rates lead to high capture rates and diversion rates. He further argued that, urban plastic waste management involves not only a

householder's participation but also a network of the state, private organisations and companies and communities to manage plastic waste effectively.

Again, the Derivan Report (2009) gathered information on the levels of awareness of, and willingness to participate in, recycling and other waste minimization activities by residents within the Rockhampton and Gladstone areas. According to the report, 78% respondents had a yellow lid recycling bin at home. Yellow lid bins in Queensland are suitable for collecting paper, cardboard, glass bottles, jars, aluminum and steel cans (including aerosols), juice and milk cartons, and plastic containers for recycling. The results in the report indicated that, 59% of respondents were sure about what items could be recycled and how, although there was some confusion with items such as pizza boxes, plastic bags and drinking glasses, all of which are currently not recyclable. He stated that, while these results indicate most people understand the importance of recycling, there is still room to raise awareness.

Dezan and Shira (2017) asserted that, in China and many other developing countries, recycling is a market-driven economic activity galvanized by securing cheap commodities for manufacturers. They mentioned that, recycling industry employs more people than any other industry except for agriculture. They further stated that, it is estimated that migrant workers collect over 90% of bottles in Beijing-China and other developing countries. According to them, the army of informal recyclers generally prefers to remain anonymous from the government and do not pay taxes. They noted that, people are often seen bicycling through cities with makeshift trailers collecting recyclables from garbage cans, recycling bins, and litter on the streets.

Dezan and Shira (2017) further indicated that, collectors regularly make arrangements with security guards from office buildings and owners of small businesses and restaurants to collect their recyclables. They argued that, although these collectors effectively fill the gap left by underwhelming public services, considerable amounts of recyclables still end up in the dump. Also, they stated that, when the price of oil and other commodities is low, there is less demand for recycled resources, recyclables can end up piled in landfills.

Chennai (2012) argued that, the burden of segregating kitchen waste (degradable) from non-degradable waste has been passed on to street beautifiers engaged by non-governmental agencies or members of self-help groups. He mentioned that, women workers sift through piles of waste to separate plastic waste that can be recycled.

2.5.4 Prospects for Establishment of Plastic Waste Recycling Factories

Zafar (2013) asserted that, disposal of plastic waste has emerged as an important environmental challenge and its recycling is facing roadblocks due to its non-degradable nature. According to him, because plastic does not decompose biologically, the amount of plastic waste in our surroundings is steadily increasing. He noted that, more than 90% of the articles found on the sea beaches contain plastic. He again stated that, plastic waste is often the most objectionable kind of litter and will be visible for months in landfill sites without degrading.

The Beston Report (2016) mentioned that, with the rapid development of the world plastic industry, more and more plastic materials are used widely than before. According to the report, at present, plastic waste is mainly solved by landfill, burning and recycling. However, both landfill and burning cause the secondary pollution, and

the scope of plastic recycling is very limited. Example is the plastic waste that is produced by household garbage and paper-making factory, which cannot be recycled. Again, the Beston Report stated that, plant applies pyrolysis technology can convert plastics into fuel oil and carbon black. The fuel oil can be widely used in industries such as steel and iron and boiler factories, ceramics, power or chemical industries etc. or used for generators to get electricity. The report further stated that, the oil output rate of PE, PP and PS can reach about 50%-70%, while that of the ABS is 40%. Besides, the report revealed that, the oil yield rate will also be affected by water percentage of the plastic and the models of pyrolysis plants.

Furthermore, AB Newswire (2017) indicated that, recycling converts scrape or plastic waste into usable product and conserves the land from conservation. According to the AB Newswire report, the global market of plastic bottle recycling is growing rapidly and focusing on scrap or plastic recycling. The report added that, such plastic bottle recycling system accounts for features like reduced waste and reusable in organisations. The report mentioned that, governments in developing countries are also adopting various initiatives for recycling plastic bottles. North America accounted for the largest share in the plastic bottle recycling market. These innovations have enabled reduced greenhouse gas emissions and impact on landfills. Again, it stated that, North America is leading the market of plastic bottle recycling whereas Asia-Pacific is expected to grow fastest during the forecast period. This has caused a shift in recycled plastic production in China and India, due to high demand and lower labor costs, along with the lower environmental, health and safety costs are driving the market in APAC.

Moreover, Nizami (2015) opined that, recycling practice is mostly carried out by informal sector in the developing countries. According to him, the waste pickers or waste scavengers take the recyclables from the waste bins and containers throughout the cities. He again stated that, the waste recycling rate often becomes high (up to 30% of total waste) by waste scavengers in some areas of same cities and towns. He mentioned that, the recycling is further carried out at some landfill sites, which covers up to 40% of total waste particularly plastic by the involvement of formal and informal sectors. He noted that, the recycled products are glass bottles, aluminum cans, steel cans, plastic bottles, and paper, cardboard, waste tire, among others depending on the area, available facilities and involved stakeholders.

Additionally, the Worldcentric.org Report (2017) stated that, plastic is difficult and costly to recycle because manufacturers and consumers discard over twenty different types of plastic, and before they can be recycled, these plastics must be collected, transported, sorted, degreased, and washed. Also, according to the report, neither private nor public agencies are investing sufficiently in the systems needed to increase plastic recycling rates. The report noted that, few manufacturers invest in the compactors and logistical systems needed to recycle their plastic scraps. Again, few public agencies invest in recycling receptacles for public spaces. It indicated that, soft plastics are also recycled such as polyethylene film and bags.

Furthermore, Hanifa (2013) asserted that, in most developing countries, waste especially plastic is collected and taken to places where the urban poor sort it to get waste that can be used to make useful materials. According to Hanifa, people would buy cheap bottled water from the shops and markets, oblivious of the fact that the bottles used were recycled yet with minimal sterilization.

On his side, Hagy (2007) asserted that, there were attempts to establish plastic recycling programme in Ghana. In the programme, the central government of Ghana charged the Industrial Research Institute (IRI) of the Council for Scientific and Industrial Research (CSIR) to explore the feasibility of the establishment of a plastic recycling programme in the country. The institute came out with a report of which the finding recommended that a pilot plastic recycling plant be set up in Pokuase, near Accra. However, he stated that, with the amount of pollution piling up in our ground, air and sewer systems, thousands of people are turning to the benefits of recycling to save money and to help save the environment.

The statements indicated that, there are high prospects for recycling plastic waste in the developing countries. The study has shown that, there is high volume of plastic waste generated in the developing countries. It also revealed that, there is different types of recycleable plastic materials that can feed plastic recycling factories in the developing countries. It emerged that, there is a huge labour force that is willing to participate in recycling schemes in the developing countries. Lastly, the study revealed that, there are high prospects for establishment of plastic waste recycling factories in the developing countries.

2.6 Summary

The literature review had highlighted the opinions of experts on plastic waste management in general. The chapter dwelt extensively and examined some categories of plastic waste management practices included more importantly are, the definitions of the concepts of plastic waste management, plastic waste disposal practices, factors that account for poor plastic waste management, effects of poor plastic waste management and prospects for recycling plastic waste in the developing countries.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

Having reviewed the literature in the previous chapter, certain issues were identified which related to the objectives of the study and which are relevant to the study of plastic waste management. The study therefore gathered data from secondary and primary sources using varied techniques. This data chapter presents detailed description of the research design, location, size and characteristics of the study area, population, research approach, sample and sampling techniques, data for the study, research instruments, data collection procedure, data analysis and presentation, validity and reliability and limitations of the study.

3.1 Research Design

The descriptive survey research design was used for the study. According to Ary, Jacobs and Rezavieh (2002), survey permits the researcher to gather information from a large sample of people relatively quickly and inexpensively**.** It was thought appropriate to use the survey method because it is the dominant form of collecting data in education and other social sciences (Fink, 2002). The descriptive survey was further considered the most appropriate design for conducting this study since it is the one that deals with things as they currently are (Creswell, 2003). Again, information gathered from the descriptive research can be meaningful or useful in diagnosing a situation since it involves describing, recording, analysing and interpreting conditions that exist. Most surveys are based on samples of a specified target population, the group of persons in who interest is expressed. They are designed to provide a 'snapshot of how things are at a specific time'. There is no attempt to control conditions or manipulate variables **(**Kelley, Clark, Brown & Sitzia 2003**).**

Creswell (2003) also noted that a survey study can be done in a short time in which investigators administer a survey to a sample or to the entire population of people in order to describe the attitudes, opinions, behaviors or characteristics of the population. Creswell (2003) however noted that, survey data is self reported information, reporting only what people think rather than what they do. Survey was also deemed appropriate for the study as the current views, attitudes and opinions of residents, traders and staffs of waste management institutions was therefore sampled. It also had the potentiality of providing a lot of information that was gathered from the respondents. The study was basically aimed at gathering useful data on those conditions and variables that could not be manipulated and which helped in analysing plastic waste management in the Bolgatanga Municipality.

The descriptive survey however is not without difficulties. Kelley, Clark, Brown and Sitzia (2003), pointed out some demerits associated with its use. These include the danger that, the significance of the data can become neglected if the researcher focuses too much on the range of coverage to the exclusion of an adequate account of the implications of those data for relevant issues, problems, or theories. Also, the private affairs of respondents may be pried into and there is therefore the likelihood of generating unreliable responses and difficulty in assessing the clarity and precision of questions that elicit the desired responses (Fraenkel & Wallen, 2005).

In spite of these disadvantages, the descriptive survey seemed appropriate. This is because the breadth of coverage of many people or events means that it is more likely than some other approaches to obtain data based on a representative sample, and can therefore be generalisable to a population (Kelley, Clark, Brown and Sitzia, 2003). Also, it has the potentiality of providing a lot of information that could be gathered

from the respondents. The design was considered useful in generating data that helped to analyse plastic waste management in the Bolgatanga Municipality.

3.2 Location, Size and Characteristics of the Study Area

The study was conducted at Bolgatanga, the capital town of the Bolgatanga Municipal Assembly and the Upper East Region of Ghana. Bolgatanga is 161 km (about 100 miles) to the north of Tamale. Bolgatanga lies in the Red Volta River Valley (which serves as a major migration route of elephants), with the White Volta River and the cliffs of the Gambaga Escarpment to the south. The cliffs form the southern boundary of the Upper East Region (Bolga.ghanadistricts.gov.gh. 2014). In the Upper East Region, Bolgatanga Municipality is bordered to the north by the Bongo District, south and east by the Talensi and Nabdam Districts, to the west by the Kassena-Nankana West Municipality and the Kassena-Nankana East District.

The area covers a total land area of 729 square kilometers. It was the first of three municipalities to be established in the Upper East Region. The other Municipalities are Bawku and Kasena-Nankana West which together with ten other districts constitute the Upper East Region of Ghana (Ghana Statistical Service, 2014).

Bolgatanga became a district in 1988 by Legislative Instrument 1453. It was called Bolgatanga District Assembly. The Bolgatanga District was later promoted to a Municipality established in 2004 by Legislative Instrument (LI) 1797 (2004). Bolgatanga Municipality is located in the centre of the Upper East Region, approximately, between latitudes 10°30' and 10°50' North and longitudes 0°30' and 1°00' West (Bolga.ghanadistricts.gov.gh. 2014).

Bolgatanga is known as the crafts centre of Upper East region, with a large open air market. Apart from items found elsewhere in Upper East region, the so-called "Bolga hats" are made and sold in Bolgatanga. Bolgatanga and its surrounding suburbs also comprise the largest producers of leather works, straw baskets and smocks. The artists sell their works at the Bolgatanga market, which is open every third day. There is also a museum in the Municipality which houses objects of historical importance of the Upper East region (Bolga.ghanadistricts.gov.gh. 2014).

Bolgatanga was described as the largest town in the Upper East Region with a large market center and included towns with developed tourism sites which attracted tourists. For example, the Tongo Hills and Shrines, the Paga Crocodile Ponds, the Sherigu Architectural Designs, Naa Gbewaa Shrine at Pusiga, Basket Weaving and Pottery Industries at Bongo and Bolgatanga areas were tourist attractions in the Upper East Region of which Bolgatanga is the Capital. Traders from Burkina Faso, Togo, Niger and Mali brought their wares to sell in the Bolgatanga town's central market. Trading and tourists activities made the town very busy. This made the Assembly generated large revenue through taxes and other form of foreign exchange for the country.

However, the residents, traders and other people in the Bolgatanga Municipality consumed lot of plastic products which were the most common materials used to package food and non-food products. The wastes were indiscriminately thrown away and littered the central business district. Other plastic products bought were plastic containers for food storage, water and other materials at homes and business establishments.

Factories and related business establishments such as restaurants and shops in the Municipality used large quantity of plastic products for their businesses. Sometimes plastic waste that were disposed in waste bins were left uncollected for several days, weeks or months which made them scattered and littered the town's environment and presented some ugly scene. During raining period, the waste produced unpleasant smell which polluted the air. It was against this background that the researcher undertook this research to analyse plastic waste management in the Bolgatanga Municipality to find lasting solutions to the problem.

Bolgatanga Municipality had an estimated population of 228,815 with sex distribution of 48.7 male and 51.3 female (Ghana Statistical Service, 2015). Approximately, twenty (20) communities made up the Bolgatanga Municipality. Some Towns and Villages in the Municipality were; Tindonsobulugu, Tindonmologo, Daporetindongo, Damweo, Yarigabisi, Zuarungu-Dachio, Gambibigo-Azuabisi, Kumbosigo, Poamoliga-Sherigu, Dorungu-Agobgabisi, Pobaga, Atulbabisi, Tanzui, Kumbangre, Bolga-Soe, Bukere, Sokabisi, Yikene-Zohbisi, Sumburungu and Zaare (Bolgatanga Municipal Assembly, 2017). Figure 3.1 is an administrative map of Ghana indicating the national capital and province capitals where Bolgatanga is one of the Province capitals at the northern sector.

Figure 3.1: An Administrative Map of Ghana

Source**:** *mapsofworld.com*

Figure 3.1 is a map of Ghana showing the locations of the national capital, province capitals and other cities. As indicated above, Bolgatanga is one of the province capital towns in the northern part of Ghana. Figure 3.2 is a map of Bolgatanga Municipality indicating the various communities in the area.

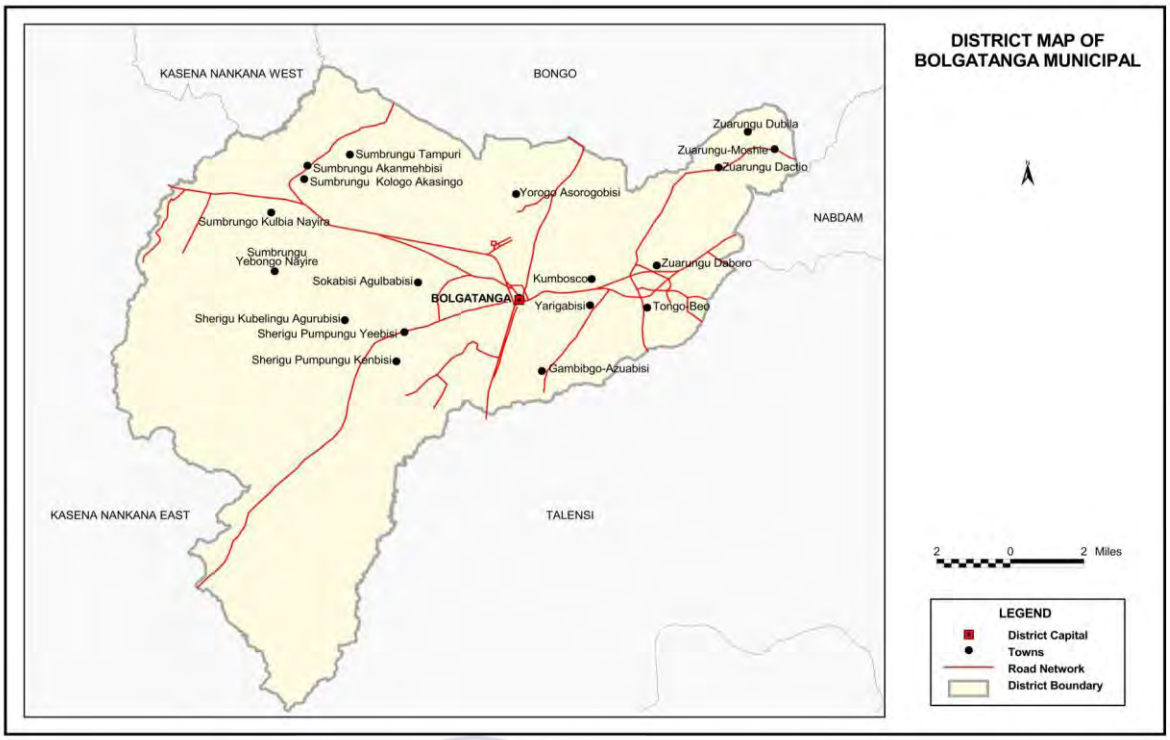

Figure 3.2: A Map of Bolgatanga Municipality

Source**:** *Ghana Statistical Service GIS*

Figure 3.2 is a map of Bolgatanga indicating the various communities in the Bolgatanga Municipality.

With the highest population indicated in the region, Bolgatanga generates more plastic waste as compared to other towns in the region. However, it appears very little is done concerning plastic waste management. There is only one final disposal site (landfill) where plastic waste were mixed with other waste and disposed off. The landfill is at Poamoliga-Sherigu, about 11 kilometers away from the Bolgatanga town. Meanwhile, plastic waste was seen scattered everywhere in the Municipality.

3.3 Study Population

The population for the study consisted of all adults in the study area. They were: residents, traders and staffs of waste management institutions in the Municipality. A population of two hundred and fifty (250) respondents was used for responses. This figure was determined because of lack of census data for the population of each selected community. Attempts were made from the Bolgatanga Municipal Assembly and the Ghana Statistical Service for census figures of the selected communities but failed. Based on this, the total population of adults from the selected communities could not be gotten.

3.4 Research Approach

The study employed the mixed methods approach for collecting the data. They included the use of both quantitative and qualitative studies. Quantitatively, the study involved the use of structured questionnaire for data collection and analysis. According to Wilson and Mclean *(1994: 3)*, "a questionnaire is an instrument for collecting survey information, providing structured, often numerical data, being able to be administered without the presence of the researcher, and often being comparatively straightforward to analysis". The questionnaire items consist of closed questions with a range of responses from which respondents choose.

Qualitatively, the study employed field observations, face-to-face interviews and taking of still photographs. Marshall and Rossman (1995); Simpson and Tuson (2003: 2) cited in Cohen, Manion and Morrison *(2007: 461)* that, "qualitative data analysis is organising, accounting for and explaining the data; in short, making sense of data in terms of the participants' definitions of the situation, noting patterns, themes,

categories and regularities. Observation is looking and noting systematically people, events, behaviors, settings, artifacts, routines".

Kvale *(1996: 14)* opined that, "interview is an interchange of views between two or more people on a topic of mutual interest, sees the centrality of human interaction for knowledge production and emphasizes the social situations of research data". He explained that, the use of interview in research marks a move away from seeing human subjects as simple manipulable and data as somehow external to individuals, and towards regarding knowledge as generated between humans, often through conversations. Cohen, Manion and Morrison *(2007: 349)* asserted that, "interview is a flexible tool for data collection, enabling multi-sensory channels to be used: verbal, non-verbal, spoken and heard. They added that, interview is a powerful implement for researchers".

3.5 Sampling Techniques

The simple random selection was employed and selected communities for the study. This was done by listing all the communities on pieces of paper, folded and put them together and picked them one after the other. The systematic sampling procedure was employed and selected households and shops for the study. It was done by numbering the households, shop and selected every third household and shop in each community. Also, the accidental sampling procedure was used and selected residents and traders to participate in answering the questionnaire. This was done by presenting the questionnaire to any first adult met in the household, shop or at workplace. The questionnaires were handed over to respondents for responses and collected later in the day or the next day.

However, the participants for the field interviews involved residents, traders and staffs of waste management institutions. The purposive sampling procedure was employed for selection of participants from the residents, traders and staffs from waste management institutions for responses. This was because the researcher needed information which could only be provided by some opinion leaders, shop owners and heads of waste management institutions.

3.6 Sample Distribution

A sample size of two hundred and fifty (250) respondents was used for the study. This consisted of residents of the five (5) selected communities, traders and staffs of waste management institutions in the study area. A total of two hundred fifty (250) questionnaires were used for responses during the field survey. About seventy (70) participants were from Bolgatanga town and forty-five (45) each from the other four communities. The participants from Bolgatanga town were more than the others because it is an urban center with high population size as compared to the other towns. Again, there is a bigger market which contains more traders who participated in answering the questionnaire. However, the other four have equal participants because the communities have similar characteristics.

The study area was zoned into five communities namely: Bolgatanga town, Zuarungu-Dachio, Sumburungu, Yikene-Zohbisi and Tindongsobulugu. As indicated earlier, the simple random selection was used and selected the five (5) communities for the survey. Out of the sample size of 250, seventy (70) participants were engaged from Bolgatanga town and the remaining one hundred and eighty (180) participants were divided equally among the four (4) remaining selected communities. Table 3.2 is the selected communities used and selected participants in the study area.

Table 3.1: Sample Size and Distribution for Questionnaire Survey

Community	Participant	Percentage
Bolgatanga town	70	28
Zuarungu-Dachio	45	18
Sumburungu	45	18
Yikene-Zohbisi	45	18
Tindongsobulugu	45	18
Total	**250**	**100**

Source: Author's Construct, 2017

A total of nine (9) respondents participated in the interviews. Five (5) residents were purposively selected from the five (5) selected communities, two (2) traders were accidentally selected from the shops or market center and two staffs purposively selected from the waste management institutions. Heads of the waste management institutions were purposively selected to participate because information needed could best be sourced from them. The traders were accidentally selected from shops or the market because the researcher needed any shop owner or sales agent to collect the data. The residents were purposively selected because the researcher needed opinion leaders living within the communities and who contain more knowledge about their communities to collect the data. Table 3.3 shows the participants who responded to the field interviews.

Table 3.2: Sample Size and Distribution for Interviews

Community	Participants	Percentage
Bolgatanga Municipal Assembly	1	11.1
ZoomLion Ghana Limited	1	11.1
Traders	2	22.3
Bolgatanga town	1	11.1
Zuarungu-Dachio	1	11.1
Yikene-Zohbisi	1	11.1
Tindonsobulugu	1	11.1
Sumburungu	1	11.1
Total	**9**	**100**

Source: Author's Construct, 2017

3.7 Data for the Study

The researcher used both qualitative and quantitative data for the study. The data were obtained based on the objectives of the study to describe plastic waste disposal practices, to examine factors that account for poor plastic waste management, to examine effects of poor plastic waste management and to explore the prospects for recycling plastic waste in the study area. The sources of data collection were primary and secondary.

Primarily, questionnaires were employed to source information from participants in the five selected communities, shop owners and from the waste management institutions. Interviews were employed which made respondents provided detailed explanation for better understanding of the content. Direct observations were used which allowed the researcher identified other issues that were not mentioned during the field work. These activities were accompanied with documentations, taking of still photographs and recording with permissions during data collection. Secondary sources were obtained from documents from participating institutions (Bolgatanga Municipal Assembly and ZoomLion Ghana Limited). They included maps, figures and reports on plastic waste management in the Municipality.

3.8 Instruments for Data Collection

The research instruments consisted of questionnaires, interviews, field observations and analysis of documents. Questionnaires were presented to participants of the study and collected data on plastic waste management. The data gathered were analysed to have a full understanding of plastic waste management in the Municipality. Field observations were employed and gathered observable data or information on the plastic waste management.

In qualitative research, experience has shown that observation and interviews are particularly mutually reinforcing research methods. Besides, they all depend on a face to face communication (Marshall & Rossman, 1999). As such, field visits to the selected communities were done to gain in-depth knowledge and understanding of the situation. It provided first hand information and impression on the dynamics and characteristics of the residents.

Face-to-face interviews were employed and gathered data from respondents. Both closed and opened ended questions were administered. Questions were focused on methods of plastic waste disposal practices, factors that account for poor plastic waste management, effects of poor plastic waste management and prospects for recycling plastic waste in the Bolgatanga Municipality. Institutional interviews were conducted with staff of the Environmental and Sanitation Unit of the Bolgatanga Municipal Assembly (ESU/BMA) and ZoomLion Ghana Limited (ZGL) for their efforts and capacities in addressing the resultant plastic waste management in the Municipality. Due to the nature of the study, observations and interviews were complemented by the taking of still photographs depicting waste collecting bins and dumpsites or landfills. These were used to validate the responses from the interviews and questionnaires.

3.9 Data Collection Procedure

The study first started by gathering and sourcing information about plastic waste management from books, newspapers, magazines and internet. Documents and maps were sourced at the Bolgatanga Municipal Assembly. Secondly, the researcher went round the whole community and observed the way plastic waste is managed in the area. However, this procedure continued until the end of the study. During the field

observation, still photographs were taken to present the reality of the situation in the Municipality.

As stated, questionnaire was used for the study**.** As the researcher desires to collect factual information on analysis of plastic waste management, a likert type questionnaire was developed to collect data for the research questions. The questionnaire consists of sixteen (16) close-ended items for residents and traders (Appendix B). Close-ended questions according to Cohen, Manion and Morrison (2003) are quick to compile and straight forward to code, and do not discriminate unduly on the basis of how articulate the respondents are. The four likert-type scale ranged from "Strongly agree" (SA), "Agree" (A), "Disagree" (D) to "Strongly Disagree" (SD). According to Ary et al (2002), the Likert scale is one of the most widely used techniques to measure attitudes. Borg and Gall (1983) found it to be popular, easy to construct, administer and score. This was distributed personally to the residents and businessmen/women of the selected communities on appointed and accepted dates. The researcher discussed the questionnaire with the people and later distributed them to respondents to answer. This was adopted by the researcher because it helped in determining values as well as views, attitudes and experiences of the respondents.

The items in the questionnaire were based on the four (4) research questions raised to guide the study. Research question one, which seeks to find out methods of plastic waste disposal practices in the Bolgatanga Municipality, had four items under it. The second research question which looked at factors that account for poor plastic waste management also had four items. The third research question which looked at effects of poor plastic waste management in the Bolgatanga Municipality had four items

raised to solicit the views and opinions of respondents. The fourth question which looked at the prospects for recycling plastic waste had four items raised to also solicit the views and opinion of respondents.

A questionnaire, according to Creswell (2003), is a form used in a survey design that participants in a study complete and return to the researcher. The author further stated that, participants mark choices to questions and supply basic personal or demographic information. Sidhu (2002) posits that, a questionnaire is that form of inquiry which contains a systematically compiled and organised series of questions that are to be sent to the population samples. Best and Kahn (1995) highlighted that questionnaire is used when factual information is desired.

Face-to-face interview was conducted for the residents and traders on one day at different points whiles that of the institutional heads was on different dates scheduled by both the researcher and the participants. The residents and traders were at their various locations and the researcher moved to them and administered the interview, making sure they understood the purpose of the interview. Again, the researcher moved to the offices of the waste management institutions and administered the interview himself.

Noting the fact that questionnaires do not provide an in-depth investigation of specific phenomenon, the researcher had to supplement the information acquired with interview. The responses were handwritten alongside the tape recording for easy analysis. The interview helped the researcher to establish the complexity of facts from the residents, traders and staffs of the waste management institutions. Creswell (2003) defined an interview survey as a form in which the researcher records answers supplied by the participant in the study. Ary et al (2002) also posits that an interview

is used to gather data on subjects' opinions, beliefs, and feelings about the situation in their own words. Kruger (1994) cited in Creswell (2003) posits that, focus groups provide for interaction among interviewees, collection of extensive data and participation by all individuals in the group. According to Ary et al (2002), these are helpful because they bring several different perspectives into contact. The researcher gains insight into how the participants are thinking and why they are thinking as they do.

3.10 Validity and Reliability

The research instruments were presented to the supervisor of the work and other senior members in the faculty for advice on their appropriateness before the actual data collection exercise. To make the test items reliable, at least three (3) people consisting of two (2) residents and one (1) trader were purposively selected to pilot the questions on the test item to determine its reliability. Also, a pilot face-to-face interview was conducted with one (1) community member and one (1) staff of the waste management institutions to determine the reliability of the test item before the actual field work was conducted.

3.11 Data Presentation and Analysis

Administered questionnaires were examined to check completeness, accuracy and consistency of responses in order to detect and eliminate errors. The data were processed into statistical tables for interpretation and discussion. Processed data were analysed both quantitatively and qualitatively. The data analysis was on methods of plastic waste disposal practices, factors that account for poor plastic waste management, effects of poor plastic waste management and prospects for recycling plastic waste in the Municipality. The data analysis were further disaggregated into

the various waste management institutions and the selected communities in the Municipality.

3.12 Limitation of the Study

The following hindered the smooth completion of the study. The first hindrance was the Assembly and the private waste management institutions' refusal or inability to provide certain documents for the study. This prevented the researcher from getting access to certain documents therefore restructured the objectives for the study. Secondly, some of the potential respondents refused to respond to the questionnaire. They expected to be compensated before responding to the questionnaire. This defeated the procedure employed in selecting respondents to respond to the questionnaires that stated, 'first adult met in a household should respond to the questionnaire'. It also defeated the procedure that, interviews should be conducted with opinion leaders in the selected communities.

3.13 Ethical Considerations

A letter of introduction was obtained from the Head of the Department of Social Studies, University of Education, Winneba. This enabled the researcher to seek consent to conduct the study and enabled the researcher to formally introduced himself to the study participants during data collection. Participants were assured of the necessary confidentiality thus their names were not written on the sets of questionnaire and interview guides.

3.14 Summary

This chapter has been on the discussions on how the researcher had gone out into the field to collect and analyse the data. Data collected came from two sources namely primary source and secondary source. Field observations, questionnaire survey and face-to-face interviews from the primary source were employed and gathered. The study also made use of the secondary source and gathered the data. The sampling technique was purposive, simple random selection, accidental sampling and systematic sampling. Data analysed both qualitative and quantitative with the use of figures and tables.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

4.0 Introduction

This chapter presented and analysed the data that were collected for the study. The data were presented and discussed under themes that reflected the research questions that guided the study on plastic waste management in the Bolgatanga Municipality. For the purpose of triangulation, three types of data were collected to answer the research questions. These were questionnaire, interview and observation data. In the case of the data that were collected with the questionnaire, the presentation took the form of tables and description of the salient aspects of the results. With regard to the interview and observation data, the presentation was done under themes that reflected the research questions.

Figures 4.1, 4.2 and 4.3 present data on the demographic background of the respondents. This was followed by the data that were collected to answer the research questions. The data is presented under the following themes: Plastic waste disposal practices in the Bolgatanga Municipality; Factors that account for poor plastic waste management in the Bolgatanga Municipality; Effects of poor plastic waste management in the Bolgatanga Municipality and Prospects for recycling plastic waste in the Bolgatanga Municipality.

4.1 Demographic Information on Respondents

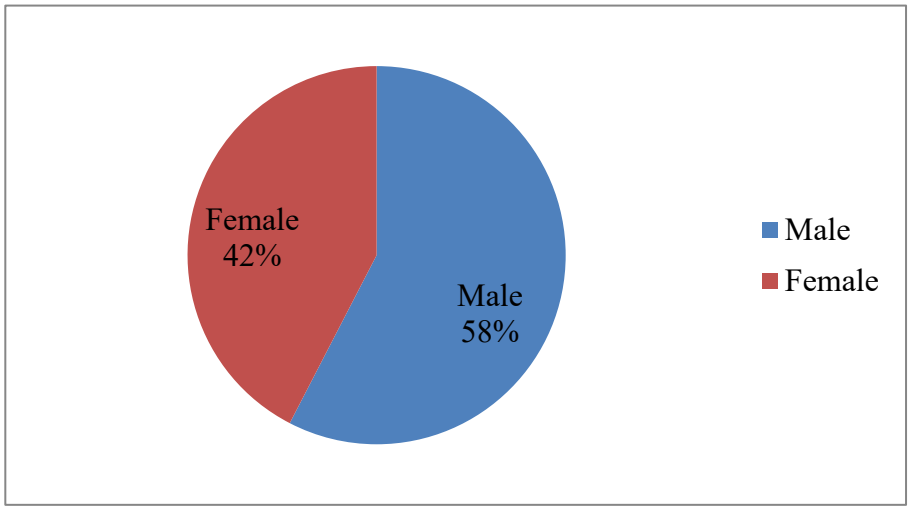

Figure 4.1: Gender of Respondents

Figure 4.1 presents data on the gender distribution of the respondents to the research items. Out of a total of 250 respondents, 42% were females while the remaining 58% were males. The gender representation was based on a rule that; 'the questionnaire is presented to the first adult met in a household, shop and/or workplace for answers in order to get all the stakeholders who are involved in generating plastic waste in the Bolgatanga Municipality.

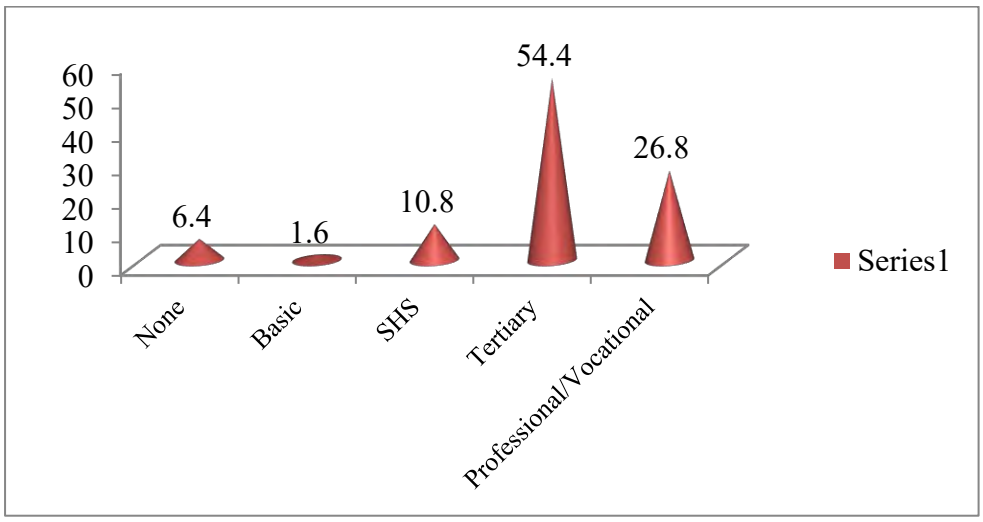

Figure 4.2: Educational Background of Respondents

Figure 4.2 depicts information about respondents' educational background. According to the Figure, 6.4% had no certificate, 1.6% had Basic JHS certificates; 10.8% had Senior High School certificates, 54.4% had Diploma and Degree certificates and 26.8% had Professional or Vocational certificates.

It is interesting to note that majority of the respondents had either a tertiary or professional education. A total of 11.4% had attained either basic or had no formal education.

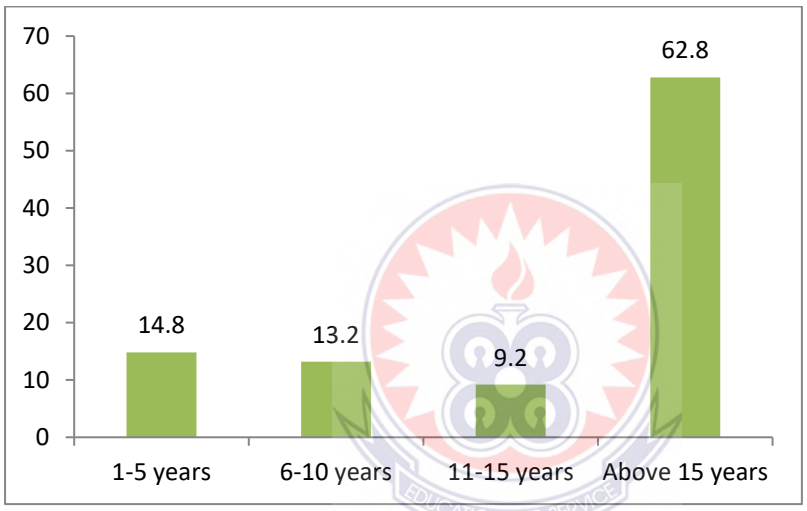

Figure 4.3: Years Respondents Stayed in the Municipality

Figure 4.3 illustrates the years respondents stayed in the Bolgatanga Municipality. In the Figure, 14.8% stayed 1-5 years in the Municipality, 13.2% stayed 6-10 years in the Municipality, 9.2% stayed 11-15 years in the Municipality and 62.8% stayed 15 years and above in the Municipality.

The number of years stayed by respondents indicated that majority (157) respondents stayed 15 years and above. They were therefore the people who contributed to plastic waste generation and management and were those who gave detailed opinions on plastic waste management in the Municipality.

4.2 Plastic Waste Disposal Practices in the Bolgatanga Municipality

Three items were constructed in the form of a likert scale for respondents to indicate the extent to which they agreed or disagreed with each statement. The statements were weighed as four for strongly agree and one for strongly disagree. For the purpose of calculation, the responses were coded using the following range of scores: Strongly agree (SA) 3.1-4.0; Agree (A) 2.1-3.0; Disagree (D) 1.1-2.0 and Strongly Disagree (SD) 0.1-1.0.

Table 4.1 presents the responses to each statement followed by discussion of the results.

Table 4.1: Plastic Waste Practices in the Bolgatanga Municipality

STATEMENT	A	D	TOTAL	M	R
Plastic waste disposal in open spaces	151	99	250	2.8	A
Plastic waste disposal in drains	203	47	250	3.3	SA
Plastic waste disposal in water bodies	150	100	250	2.8	A
Total = 8.9 Mean of means = 2.9					

For the purpose of analysis, Table 4.1 presents data on plastic waste disposal practices in the Bolgatanga Municipality. The data shows that generally, respondents agreed with the statement that plastic waste was disposed off in open spaces. The item recorded a mean score of 2.8 which falls within the values for agree. On whether plastic was disposed in drains, a mean score of 3.3 was recorded and this corresponds with values for strongly agree. Similarly, a mean score of 2.8 which corresponds to "Agree" was recorded for the statement that plastic waste was disposed off in water bodies. An overall mean score of 2.9 was recorded for all the items and this corresponds with the values for agree. This means that, generally, the popular

methods of plastic waste disposal in the Municipality include plastic waste disposal in open spaces, drains and water bodies.

4.2.1 Plastic Waste Disposal in Open Spaces in the Bolgatanga Municipality

The study found that plastic waste disposal practices in the Bolgatanga Municipality were largely dependent on residents and traders. It revealed that, respondents affirmed with the statement on *plastic waste disposal in open spaces* in the Bolgatanga Municipality. This was confirmed in the study during observations that, refuse, most of which were plastics were disposed off in incomplete buildings, behind houses, farmlands, roadsides and bushes rather than in bins. Figure 4.4 illustrates plastic waste disposal in a bush at Bukere, a suburb of Bolgatanga town.

Figure 4.4: Plastic Waste Disposed in an Open Place at Bukere

It was observed that, residents indiscriminately littered their surroundings with plastic waste. It was common to see travelers throwing plastic waste through the windows of moving vehicles. Others were seen throwing used sachet rubber, plastic bottles and film polythene bag indiscriminately in open places. Figure 4.5 illustrates a littered environment at Tanzui-Bolgatanga town.

Figure 4.5: Plastic Waste Littered at Tanzui-Bolgatanga

In an interview with residents, further views were sought on the reasons for people disposing plastic waste in open spaces and not in bins. One of the residents gave these explanations similar to what others expressed:

> *...we do not separate plastic waste from others... we mixed them with other refuse and take them to the dumpsite...sometimes we take our refuse to incomplete building and the bush down the valley...others hide early dawn and dump refuse at the roadside...we do these because there are no big metal containers closer to us (Verbatim expressions by a resident)*

Similar views were expressed by traders at the Bolgatanga central market. For example, when traders were asked to describe the plastic waste disposal situation in the market, this was what one of them said which were similarly expressed by most of them:

> *...the market is filthy because people throw refuse which is mostly plastics all over the market...traders sweep their surroundings and leave their refuse in front of their shops and others hide and dump them under other people's shops making the market environment ugly and smelling...the situation is horrible when it rain but the Assembly is doing nothing about it (Remark by a trader)*

During the study, observations have shown that, generally people indiscriminately litter the environment. Some people disposed off their plastic waste in incomplete

buildings, others in the bushes or roadsides and some disposed them at dumpsites closer to their houses. The finding gives a clear indication that, Bolgatanga Municipal Assembly and the private waste management institutions were ineffective and not up to task in waste management in the Municipality.

4.2.2 Plastic Waste Disposal in Drains in the Bolgatanga Municipality

As shown in Table 4.1, majority (151 out of 250) of the respondents strongly affirmed with the statement on *plastic waste disposal in drains* in the Bolgatanga Municipality. It emerged that, most of the residents, traders and people were involved in the practice. Though people were seen disposing off plastic waste in drains, they were not punished for the act which implied that there is lack of enforcement of environmental laws in the Municipality. It was observed that, most of the drains were not covered. This uncovered nature of the drains made people got easy access to dispose off plastic waste and other refuse in them.

Respondents were further asked to explain reasons why people dispose off plastic waste in the drains. Majority attributed the practice to lack of law enforcement and the open nature of the drains. The explanation below represents the views of the generality of the respondents:

> *...the drains are not covered and people throw all sorts of refuse in them…some people dump waste in the drains because everybody is seen doing that and authorities seem to care less about it (Comment by a resident)*

Comments on the same issue were made by a trader at the Bolgatanga central market who revealed that:

> *... the gutters in the market are not covered and people dump plastic waste and refuse in them…the practice makes all the gutters to be choked causing water to enter our shops anytime it rains… it makes the gutters to have bad smell and ugly scene with waste especially plastic waste in them (Comments by a trader)*

It is clear from the discussion above that, the Bolgatanga Municipal Assembly does not enforce its by-laws on sanitation and waste management. Aside, the construction of open drains in the Municipality appears to be encouraging resident to be using such places as dumping sites.

4.2.3 Plastic Waste Disposal in Water Bodies in the Bolgatanga Municipality

The research found that, 150 out of 250 respondents affirmed with the statement on *plastic waste disposal in water bodies* in the Bolgatanga Municipality. The 'Kolaa' river, a tributary of the White Volta and other small streams pass through the Bolgatanga Municipality. Some residents and livestock depend on this river for their source of water. However, it was observed that, this river was getting choked with plastic waste of all kinds. For instance, the section of the Kolaa River that runs through the Municipality is reported to be frequently overflowing its banks in recent years. Settlements along these banks usually get flooded with its attendant problems. These floods could be attributed to the dumping of plastic waste into the water channels. Residents also indicated that, the river used to be a source of fish throughout the year. However, this is no more possible because the channel is choked and the water heavily polluted with all manner of waste, particularly, plastics.

Respondents were asked for views on the reasons why there were not fishing in the Kolaa River. Several views were made on the issue. One resident commented on it with views similar to those expressed by all the respondents:

> *...residents who leave near the Kolaa river, mostly dump their waste in it…the waste poisons the fish and this has reduced the volume of fish we used to catch from the river… people who do fishing activities said they now spend most times fishing and catching plastic waste instead of fish…sometime, we see fish dead at the banks of the river supposedly to be poisoned by waste (Verbatim expression by a resident).*

It emerged that the Bolgatanga Municipal Assembly is ineffective in monitoring the activities of residents in dealing with the plastic waste disposal in water bodies in the Municipality. The study found that, the Environmental Sanitation Unit of the Bolgatanga Municipal Assembly has low staff strength for this reason; they could not do effective plastic waste management as considering the large nature of the Municipality.

It revealed that, plastic waste disposal in bins were not popular in the Bolgatanga Municipality as compared to disposal in open spaces, drains and water bodies. Residents who live in low class residential areas have either no bin or one bin to dispose their plastic waste. Again, it emerged that, there were no individual bins found in the low class residential areas as in the high class residential areas. For these reasons, residents in the low class residential areas disposed off waste, particularly plastic in unauthorised places. Meanwhile residents who live in high class residential areas were provided with bins placed in front of their houses for waste collection. This means that, those who live in the high class residential areas had access to plastic bins to dispose off their plastic waste. Figure 4.6 illustrates plastic waste collection using bins at high class residential areas at Zuarungu in the Bolgatanga Municipality.

Figure 4.6: A Plastic Bin for Waste Collection at Zuarungu

Those who live in low residential areas were not supplied with bins which made them disposed off plastic waste in unauthorised places. Again, it indicated that, there were delays in collecting waste in communities that were provided with the bins. This caused the waste to overflow at the collection points increasing the problems of littering. Figure 4.7 illustrates uncollected waste mixed with plastics that overflows from a bin at Damweo, a suburb of Bolgatanga town.

Figure 4.7: Uncollected Wastes Mixed with Plastics at Damweo

The data indicated that, only high residential areas were provided with the bins but the low class residential areas were either provided with one bin or none. It implied that, plastic waste disposal, collection and management were in different ways depending on the area one lives. The data revealed that, the inability of the Bolgatanga Municipal Assembly to provide all areas with bins resulted in residents, traders and people disposed off plastic waste in unauthorised places instead of the appropriate ways.

Interviews conducted with staff of the Environmental Sanitation Unit of Bolgatanga Municipal Assembly (ESU/BMA) on reasons why all areas in the Municipality were not provided with bins, the following were the explanations provided which represented the Assembly position on waste management:

> *...plastic waste is not segregated from other solid waste for disposal because, the Assembly is unable to provide separate bins for people to dispose plastic waste in separate bins due to lack of funds... the Assembly does not have enough funds to provide skips for all areas especially the rural areas but doing its best at the urban areas...some places do not have skips due to their poor nature of handling them...some dump ashes containing fire in them burning the containers beyond repairs and other areas do not have space to place the skips...effort are being made with chiefs and Assembly members to acquire more land spaces to put more communal skips to areas without them...the Assembly is encouraging residents and traders to register with the private waste management companies in the Municipality such as the ZoomLion, Steward and Clean Mop for individual household bins to dispose their waste but because this involves monthly fees charge, people are reluctant to register... several campaigns and education is going on to make people aware of proper plastic waste disposal practices (Verbatim expression by a staff of ESU/BMA).*

It was evident that, the Assembly and the private institutions responsible for waste management in the Municipality could not provide all areas with bins to collect plastic waste. This resulted in residents and traders disposed off their plastic waste in unauthorised places. It emerged that, the Assembly and the private waste management institutions delay in collecting the waste at the collection points. This makes plastic waste scattered in all places in the Municipality increasing the plastic waste problems.

Again, it revealed that, plastic waste disposal in open spaces, drains and water bodies were popular methods than dispose in bins. The finding confirms a research conducted by Ampofo, Kumi and Ampadu (2015) which stated that, the factor identified for contributing to improper domestic solid waste management in the Bolgatanga Municipality is the inadequacy of information on proper solid waste disposal. They indicated that about 28% of the households practiced door-to-door collection method in Bolgatanga Municipality.

4.3 Factors that Account for Poor Plastic Waste Management in the Bolgatanga Municipality

Four items were constructed in the form of a likert scale for respondents to indicate the extent to which they agreed or disagreed with each statement. The statements were weighed as four for strongly agree and one for strongly disagree. For the purpose of calculation, the responses were coded using the following range of scores: Strongly agree (SA) 3.1-4.0; Agree (A) 2.1-3.0; Disagree (D) 1.1-2.0 and Strongly Disagree (SD) 0.1-1.0.

Table 4.2 presents data on factors that account for poor plastic waste management as indicated on the questionnaire by residents, traders and staffs of the waste management institutions. The presentation of the data on Table 4.2 is followed by a discussion on the interviews and observation results.

Table 4.2: Factors that Account for Poor Plastic Waste Management in the Bolgatanga Municipality

STATEMENT	A	D	TOTAL	M	R
Lack of dumping sites for plastic waste disposal	130	120	250	2.6	A
Ignorance on plastic waste management	123	127	250	2.5	A
Poverty contributes to plastic waste management	193	57	250	3.2	SA
Non enforcement of environmental laws	157	93	250	2.9	A
Total = 11.2 Mean of means = 2.8					

Table 4.2 presents the data on factors that account for poor plastic waste management in the Bolgatanga Municipality. On the question whether there is lack of dumping sites for plastic waste disposal in the Bolgatanga Municipality, the item recorded a mean score of 2.6 which falls within the values for agree. On whether ignorance on plastic waste management is one of the factors, a mean score of 2.5 was recorded and

this corresponds with values for agree. On whether poverty contributes to plastic waste management, a mean score of 3.2 was recorded which falls within values for strongly agree and on whether non enforcement of environmental laws is a factor that account for poor plastic waste management in Bolgatanga Municipality, a mean score of 2.9 was recorded with values which corresponds with agree. In effect, respondents generally agreed with the objective with a mean score of 2.8 recorded.

4.3.1 Lack of Dumping Sites for Plastic Waste Disposal in the Bolgatanga Municipality

Based on the analysis of the data, 130 out of 250 respondents affirmed with the statement that, *lack of dumping sites for plastic waste disposal* is one factor that account for poor plastic waste management in the Bolgatanga Municipality. It was observed that, residents and traders used more plastic materials for most activities but have no places to dispose off them. The traders live their plastic waste closer to their shops while residents dump theirs in any available space near them. It was further observed that, the Bolgatanga central market had only one dumping site which was placed far at a corner. Few areas in the Municipality have dumping sites for waste collection. This implies that, the Assembly did not adequately provide enough bins for residents and traders to dispose off their waste especially plastic. As a result, the situation caused residents and traders to create their own dumping sites either in the open spaces, drains and water bodies causing environmental problems in the Municipality. For these reasons, plastic waste was seen scattered everywhere. The waste was seen at unapproved dumpsites, near homes, public places like markets, lorry parks, stations, among others.

When respondents were asked for views on reasons why plastic waste was found at every place in the Municipality, several views were expressed and one of the residents made comments which were similar to those provided by the others:

> *…everything we buy is put in plastic polythene bag for easy handling, sometimes the thicker ones are used severally but the light one which are cheaper and not durable are thrown away immediately after use…because of their nature, they easily worn out and are disposed and replaced…the Assembly is unable to supply enough big metal containers to dump our waste (Verbatim expression by a resident).*

Similarly, traders were asked and sought views on why plastic waste is found everywhere and not in bins. One trader commented on the issue which was generally expressed by all the other traders as:

> *…everybody use plastic products to do one thing or the other…most products sold in the market are made either fully or partially with plastics…whatever item bought is parceled or packaged in plastics, especially the polythene film bags are mostly used to carry items…when these plastics are carried away, the users throw them away when not needed…we those in the market generate the largest quantity plastic waste and we also throw them away similar way when they are not needed (Comments by a trader).*

Based on the analysis of the data, respondents affirmed that there is lack of dumping sites in the Bolgatanga Municipality. It emerged that, residents consume a lot of plastic products resulted in increase in plastic waste generated in the Municipality. Meanwhile the waste was not effectively managed allowing it to appear everywhere in the Municipality. It therefore implies that, the Assembly and the private waste management institutions were ineffective in managing the waste generated. This is evident when plastic waste was seen at every corner in the Municipality. It is clear that authorities in the Bolgatanga Municipal Assembly did not put adequate measures to effectively collect and manage plastic waste and solid waste in general in the Municipality.

4.3.2 Ignorance on Plastic Waste Management in the Bolgatanga Municipality

Table 4.2 indicates that, 123 out of the 250 respondents agreed with the statement that, *ignorance on plastic waste management* is another factor that account for poor plastic waste management in the Bolgatanga Municipality. This implies that generally, about half of the respondents affirmed with the statement. During field observation, it was found that, there were no educational programmes on plastic waste management, going on in the Municipality by the Bolgatanga Municipal Assembly. This resulted in residents and traders disposed off their plastic waste in unauthorised places. It was also observed that, residents burnt their plastic waste at homes and unapproved dumpsites and others disposed off theirs in pits closer to their homes. The situation resulted in air pollutions and bad smell especially in the crowded settlements. This means that, residents could suffer from diseases caused by air pollution through the burning and bad air produced by the waste. The study found that, lack of knowledge on plastic waste management compelled most residents to find their own way of disposing plastic waste in unhealthy manner in the Bolgatanga Municipality.

4.2.3 Poverty Contributes to Plastic Waste Management in the Bolgatanga Municipality

Based on the data, 193 out of 250 respondents strongly affirmed with the statement on *poverty contributes to plastic waste management* is one other factor that account for poor plastic waste management in the Bolgatanga Municipality. From the data analysis, it revealed that, there is high poverty in the Municipality. Through observation, it was realised that, residents living in low class residential areas could not register and pay for individual household bins for waste collection because they were poor and could not afford the services. The residents rather depended on the few

bins provided by the Assembly for free waste disposal. However, plastic bins were supplied to those who live at the high class residential areas. Meanwhile, it was observed that, this group of people formed the minority in the Municipality's population. It therefore implies that few people could afford for waste management services but majority could not. The situation resulted in making residents resort to unhealthy ways of disposing and managing their plastic waste in the Municipality.

The study emerged that, the Bolgatanga Municipal Assembly lacks funds to adequately provide bins to effectively collect and manage plastic waste in the Municipality. For instance, preliminary survey emerged that, financial records by the Assembly on waste management revealed that, the Bolgatanga Municipal Assembly lack funds, hence, allocates small amount of money for waste management for the 2016. The revenue gained for both Internally Generated Fund (IGF) and District Assembly Common Fund (DACF) for the Bolgatanga Municipal Assembly was far more than the expenditure allocated for waste management for 2016. Table 4.3 illustrates the revenue and expenditure on waste management for 2016 by the Bolgatanga Municipal Assembly.

Table 4.3: Revenue and Expenditure for 2016

Source of Revenue	**Amount Received (Gh₵)**	**Amount Spent (Gh₵)**
Internally Generated Fund	1.964,384.25	894,000
District Assembly Common Fund	2.390,140.11	___
Total	**4.354,524.36**	**894,000**

Source: Bolgatanga Municipal Assembly, 2017

Based on Table 4.3, the Assembly expenditure on waste (including plastic waste) management for the year 2016 was Gh₵894,000 allocated to the Environmental

Sanitation Unit. The expenditure included fuel for waste collection; maintenance of vehicles, purchased of tools and equipments, fumigation of the landfill and administrative duties. It means that, a total of Gh₵894,000 was the expenditure on waste management out of the total revenue of Gh₵4.354, 524.36 received in 2016. Internally Generated Fund (IGF) generated 1.964, 384.25 and the District Assembly Common Fund (DACF) was 2.390, 140.11 received for the 2016. It further implies that, 20.5% of the Assembly's revenue was spent on waste collection and management for 2016. This implies that, the Assembly's Internally Generated Fund (IGF) alone could fund waste collection and management in the Municipality. It also means that, no amount was taken from the District Assembly Common Fund (DACF) to finance waste management. In effect, waste management does not take much of the Bolgatanga Municipal Assembly's revenue. It emerged that, the high rate of poverty is not applicable to only the residents but also on the Assembly who is responsible for waste management. This means, until such a time that the central Government and other stakeholders interested in waste management come to the aid of the Municipality, the problems of plastic waste management will continue to exist.

Open-ended questions were asked and views sought from respondents on the reasons why they were not registering for individuals' waste bins to dispose off their plastic waste. One of the respondents gave an account on the situation which was similar to the views expressed by others residents:

> *...we do not have money to register for the individual bins to be placed in our houses for waste collection...we used to dump waste in one big metal container that was placed at the market for free but somebody went and dumped ashes containing fire and the container burnt...the Assembly never returned it after taking it away...other people rather come asking us to register and collect individual bins, pay monthly for them to collect them but we did not register because we cannot afford (Comments by a resident).*

It emerged that, there were three private waste management institutions in the Municipality supporting the Assembly in waste management. These were; ZoomLion Ghana Limited, Steward and Clean Mop. It was observed that, these private companies were concentrating more on the high class residential areas who have the ability to afford for their services than the low residential areas that were poor and could not afford their services. However, the ZoomLion Company was the only private company that partners the Assembly in waste collection with the use of the communal bins at the low residential areas where fees were not charged.

A staff of the Environmental Sanitation Unit of the Bolgatanga Municipal Assembly was asked of the reasons why there was inadequate supply of bins in the Municipality. The following were his explanations which formed the view of the Assembly:

> *…the Assembly has no money to provide logistics for waste management…skips needs rehabilitations and trucks needs repairs but there is no funds for them…there are about three trucks on road but our skips services is supported by the ZoomLion company…other private waste management institutions in the Municipality such as Steward, Clean Mop and ZoomLion mostly deal with waste collection at the high class residential areas...there is free waste disposal in communal skips which the Assembly collect from the low residential areas because they cannot afford…however, the private waste management institutions collect monthly fee for waste collection in the high class residential areas (Remarked by a staff of ESU/BMA).*

It emerged that, poverty contributes to the poor plastic waste management in the Bolgatanga Municipality. The poverty was not only affecting residents but also the Assembly as well. This is evident when bins and truck were seen broken down without rehabilitations and repairs. The data indicated that, the Assembly released funds to purchase tools, equipment and machine for waste management but this was in adequate. Also, it was observed that, residents could not afford to pay a fee for waste disposal which resulted in poor plastic waste management in the Municipality.

4.3.4 Non Enforcement of Environmental Laws in the Bolgatanga Municipality

The research found that, 157 out of 250 respondents affirmed with the statement that, *non enforcement of environmental laws* is a factor that account for poor plastic waste management in Bolgatanga Municipality. It was observed that, the Assembly monitoring system was ineffective as a result of low staff strength in the Environment Sanitation Unit of the Assembly coupled with large coverage area which made them ineffective in applying appropriate sanctions against people who manage their plastic waste poorly. It was also observed that, residents were not properly educated about environmental by-laws as a result, people used poor methods of plastic waste management which went against the environmental laws.

Respondents were asked to seek their views on whether they knew any by-laws on waste management in the Municipality. Several opinions were presented and one of the respondents gave comments which were similarly mentioned by other respondents as views expressed by all:

> *... people dump waste at wrong places and are not but no law punished them…people in moving vehicles throw plastic waste through the windows and nobody even the police would not arrest them nor arrest the drivers of those vehicles… people freely dispose their waste at any available place they wish and nothing happens to them and so it seems to be a normal practice in the Municipality (Remark by a resident)*

Similarly, a staff of the Environmental Sanitation Unit was asked on the reasons why residents wrongly dispose off their plastic waste and are seemed not to be punished, and these were his explanations:

> *...the unit in the Assembly has low staff strength to monitor the whole Municipality because it is large so people take that opportunity to do the wrong things…the unit staffs sometimes save warrants to defaulters to appear in court for charges but this is not effective due to our level of poverty…when that happens people will come begging to be freed…the unit however needs support from other institutions such as*

the Police to effectively apply the laws (Comments by a staff of ESU/BMA).

It is evident from the views expressed that, the Assembly is ineffective in enforcing environmental laws in the Municipality. This implies that, residents will continue to dispose off plastic waste at wrong places and that plastic waste will continue to exist in unauthorised places.

It emerged that, low staff strength and capacity with large area of operation renders the Assembly and the waste management institutions inefficient in the execution of their duties. Again, lack of environmental laws implementation was a contributed factor to the poor plastic waste management in the Municipality.

The findings were similar to what Siddiqui and Pandey (2013) write, plastic bottles and sachets have become prevalent all over developing countries, particularly, urban areas. According to them, the packaging revolt has not been backed by proper plastic waste management policy, which has left a lot of cities littered with plastic wastes, hence, creating horrible visual troubles and other community health problems.

However, the findings were similar to what the Angelfire Report (n.d) states which listed the causes of poor domestic waste in the developing countries. They includes: Lack of dumping sites, that is, where to deposit the solid waste; Ignorance of the masses about the need to dispose off these wastes well and how to dispose off them (the wastes) off; Others are: Lack of literacy programmes on waste management which leaves most of the people backward on waste management due to lack of sensitization of the masses by the government and other organizations; Inefficient collection method which is mainly due to lack of funds to provide the necessary machinery is one of the challenges of the waste management institutions in most

developing countries; Poor government attitude towards waste management; Poverty that exists in most developing countries; Lack of trained manpower or personnel and Lack of recycling facilitates in most parts of the developing countries.

4.4 Effects of Poor Plastic Waste Management in the Bolgatanga Municipality

This section contains five items constructed in the form of a likert scale for respondents to indicate the extent to which they agreed or disagreed with each statement. The statements were weighed as four for strongly agree and one for strongly disagree. For the purpose of calculation, the responses were coded using the following range of scores: Strongly agree (SA) 3.1-4.0; Agree (A) 2.1-3.0; Disagree (D) 1.1-2.0 and Strongly Disagree (SD) 0.1-1.0.

Table 4.4 presents the responses to the statement, followed by a discussion on the interviews and observation results.

Table 4.4: Effect of Poor Plastic Waste Management in the Bolgatanga Municipality

Statement	A	D	TOTAL	M	R
Poor plastic waste disposal spread diseases	188	62	250	3.0	SA
Plastic waste in drains causes floods	187	63	250	3.0	SA
Plastic waste burning causes air pollution	155	95	250	2.8	A
Plastic waste in water bodies cause water pollution	168	82	250	2.9	A
Plastic waste littering degrades the land	202	48	250	3.2	SA
Total = 14.9 Mean of means = 3.0					

Table 4.4 presents data on effects of poor plastic waste management in the Bolgatanga Municipality. The data shows that generally, respondents strongly agreed with the

statement on *effects of poor plastic waste management in the Bolgatanga Municipality*. The item recorded a mean score of 3.0 which falls within the values for strongly agree on whether plastic waste disposal spread disease. On whether plastic waste in drains causes floods, a mean score of 3.0 was recorded and this corresponds with values for strongly agree. On whether plastic waste burning causes air pollution, a mean score of 2.8 was recorded and this corresponds with values for agree, on whether plastic waste in water causes water pollution, a mean score of 2.9 was recorded and this corresponds with values for agree and plastic waste littering degrades the land, a mean score of 3.2 was recorded and this values for strongly agree. In effect, respondents strongly agreed to the statement, a mean score of 3.0 was recorded which corresponds with values of strongly agree.

Based on the above presentation, the popular effects of plastic waste are; poor plastic waste disposal spread diseases, plastic waste in drains causes floods, plastic waste in water causes water pollution and plastic waste littering degrades the land.

4.4.1 Poor Plastic Waste Disposal Spread Diseases in the Bolgatanga Municipality

As shown in Table 4.4, 188 out of 250 respondents strongly affirmed with the statement that *poor plastic waste disposal spread disease* in the Bolgatanga Municipality. Observations have shown that, the health facilities in the Municipality were always seen full to capacity with patients struggling for treatment. This implies that, majority of residents frequently fall sick. Further observations have shown that, the common diseases diagnose in the health facilities were malaria, cholera, dysentery and typhoid fever which could be attributed to the poor sanitation situation resulting from poor plastic waste management in the Municipality. It was also observed that, the Municipality was seen with waterlogged areas believed to be dug for constructions

and left uncovered. These areas were found with stagnant water which formed the greater part for breeding mosquitoes and other dangerous insects resulting into the spread of diseases in the Municipality. Again, dumpsites, gutters and uncollected waste bins were breeding grounds for mosquitoes, flies and insects. These mosquitoes, flies and the insects spread diseases and as a result make residents fall sick frequently. Figure 4.8 illustrates stagnant water at a dumpsite which contains plastic waste and other refuse floating in it.

Figure 4.8: Plastic Waste Floating in Water at the Landfill-Sherigu

Respondents were asked to seek views on reasons why the health facilities were always full with patients struggling for treatment. They were several opinions from the residents which were similar to a comment made by one:

> *... there are stagnant waters dotted all over the town containing all sorts of materials mostly plastic waste dumped by people in our surroundings…these stagnant waters breed mosquitoes, flies and other dangerous insects which bite and make us fall sick at all times…this makes our hospitals to be full with patients queuing for treatment everyday…sometimes, there are outbreaks of disease like cholera and people die as a result of waste dispose wrongly…the waste particularly plastics breed mosquitoes and other dangerous flies that bite us and give us sickness (Verbatim expression by a resident).*

It emerged that, delays in plastic waste collection, unauthorised dumpsite and waterlogged areas were places that spread diseases in the Bolgatanga Municipality. This implies that, the Assembly and private waste management institutions were ineffective and not up to the task on waste especially plastic waste management. The study revealed that, poor plastic waste disposal spread diseases and as a result causes poor health problems to residents.

4.3.2 Plastic Waste in Drains Cause Floods in the Bolgatanga Municipality

The data in Table 4.4 indicates that, 187 out of 250 respondents strongly agreed with the statement on *plastic waste in drains causes floods* in the Bolgatanga Municipality. It was observed that, some areas in the urban center experienced flood cases. Areas such as Sawaaba and Damweo in the Bolgatanga town experience floods during the raining seasons. Further observations have shown that, residents closer to the Kolaa River structures and farmlands were always flooded anytime there was heavy downpour. It was also observed that, drains in the central business district were choked with plastic waste prevented water from passing through them and as a result causes floods during heavy rains.

Open-ended question were asked to seek views from respondents on reasons why some areas experience floods frequently in the Municipality. Several opinions were given and one respondent mentioned other consents which were similarly expressed by others:

> *…when it rains heavily, the water overflows from the gutters and enter into our houses carrying dirty waste materials mostly plastics into our rooms…the water sometimes breaks houses and carry away their belongings…when this happens, we always struggle to move upland to save our lives because the water sometimes even carries people and animals away…it also destroys our farmlands making us to lose almost everything…common areas that experienced the flood situation are*

> *Sawaaba and Damweo where the town passes through(Comments by a resident).*

In an interview with a staff of the Environmental Sanitation Unit of Bolgatanga Municipal Assembly (ESU/BMA), views were sought on the Assembly plans to control flood cases in the Municipality. The following were the comments made which represented the views of the Assembly:

> *…the Assembly constructed large drains through Sawaaba and Damweo, the flood prone areas to make water flow easily during the rains…the Assembly also covered most drain in the central business district to control the attitude of disposing waste in the drains…there are however more drains that are not covered and surely will be done when there are funds… the actions taken by the Assembly have greatly reduced flood cases but not completely (Comments by a staff at ESU/BMA).*

It emerged that, poor attitudes of residents towards plastic waste management contributed to the floods in the Municipality. The poor methods of disposing plastic waste in drains were contributory factors to the floods. The data indicates that, though the Assembly had attempted in solving the flood problems, there was still more to be done. It was observed that, floods still exist during the rains. The fact is that, the Bolgatanga Municipal Assembly is unable to cover all the drains and to construct larger drains to carry water away freely. This means that, the floods will continue to exist and the authorities need immediate measures to prevent the situation from getting worst.

4.3.3 Plastic Waste Burning Causes Air Pollutions in the Bolgatanga Municipality

The analysis on Table 4.4 shows that, 155 out of 250 respondents affirmed with the statement on *plastic waste burning causes air pollution* in the Bolgatanga Municipality. It was observed that, plastic waste and other refuse at dumpsites were burnt with smoke coming from all parts which resulted in air pollution in the

Municipality. It was observed that, plastic waste was burnt at most homes at the rural communities. It emerged that, plastic waste burning could cause air pollution and affect the lungs thereby leading to respiratory diseases. The situation leads to poor health of residents. This implies that, plastic waste burning does not only pollute the air but could also cause respiratory diseases leading to poor health of the people.

Respondents' views were sought on reasons why they were burning plastic wastes. Many people expressed similar opinions and one of them mentioned that:

> *...burning of plastic waste is done in all the areas in Bolgatanga because plastic waste is seen scattered at every place and the Assembly cannot control them and so the best way to reduce the spread is to burn them...people burn dumpsites and this produces smoke which is inhaled by us... these are the causes of our lung problems which leads to coughing...tuberculosis is now common caused by the smoke from waste burning which cause lung diseases affecting most residents making them weak and this cause them to be admitted at the hospitals for several months before they can recover... though we know waste burning is not the best because the smoke affects our health but we have no option...even sometimes the Assembly staffs themselves burn the waste at dumpsites (Remark by a resident)*

It emerged from the findings that, plastic waste burning by residents as a method of managing plastic waste could cause air pollution which could lead to health problems of the residents in the Municipality. It can also cause pollution and heating of the atmosphere which can cause global warming leading to green house effect. Plastic waste burning method still exists in the Municipality and therefore, there is the need for an immediate remedy to control it.

4.3.4 Plastic Waste in Water Bodies Cause Water Pollution in the Bolgatanga Municipality

Table 4.4 above shows that, 168 out of 250 respondents affirmed with the statement on *plastic waste in water bodies' cause water pollution* in the Bolgatanga Municipality. It was observed that, the water bodies around the urban areas were heavily polluted. There were plastic waste and other solid waste floating in the water bodies and some around the banks of the water bodies. The Kolaa River, a tributary of the White Volta and the Maclean dam that used to be the source of water for residents and livestock closer to them were seen heavily polluted with plastic waste. There were no active fishing and other activities done indicated that the water bodies were no longer beneficiary to the residents.

Respondents were asked to seek views on the reasons why people do not use the water bodies in the Municipality. Several opinions were given on the issue and one of the residents gave a comment which was generally expressed by the other respondents:

> *...the Maclean dam and the Kolaa River in Bolgatanga town are polluted with waste dumped in them by residents...nobody fish in them again as compared to some time ago where people used to fish in them and had so much catch... the water bodies contains more plastic waste most of which are film polythene bags and sachet rubbers which polluted the waters beyond the levels that they can be used (Verbatim expression by a resident).*

Responses were also sought from a staff of Environmental Sanitation Unit of Bolgatanga Municipal Assembly (ESU/BMA) to seek views on the Assembly plans to control pollution in the water bodies in the Municipality. He gave comments which formed the general views of the Assembly as:

> *...Assembly had not done much on the pollution of the water bodies...however, residents are advised not to build closer to the river banks and the unit staff does monitory of areas closer to the water*

bodies educating them to stop putting waste in the water bodies (Comments by a staff of ESU/BMA)

It emerged from the analysis that, water bodies in the Municipality especially, those closer to the Bolgatanga town were heavily polluted with waste, particularly plastic. The situation has made residents deserted those water bodies as a result of pollution. This means that, the Assembly did not put much effort to control the level of water pollution in the area. There is therefore the need for the Assembly to take serious measures to control the problem on water pollution since the situation still exists in the Municipality.

4.3.5 Plastic Waste Littering Degrades the Land in the Bolgatanga Municipality

The data shows that, 202 out of the 250 respondents strongly affirmed with the statement on *plastic waste littering degrades the land* in the Bolgatanga Municipality. Observations indicated that, plastic waste were scattered at every corner in the Municipality. The situation was not different at the rural communities though it was more serious in the urban center. At the rural communities, farmlands closer homes were littered most of which were black polythene film bags and sachet rubbers which implied that, residents indiscriminately litter their environment. At the urban center, the situation was worse where plastic waste were seen scattered around and closer to houses and some partly buried on the ground.

A visit to the landfill revealed that, the site was in a bad shape. Ideally, a sanitary landfill should have the following functional elements; weighbridge, internal access, treatment plant, leachate collection system, gas recovery and the location should be far away from human settlement and existing water body. This was not the case with the landfill site at Poamoliga-Sherigu, a community in the Bolgatanga Municipality.

The landfill site has no internal access and it was close to a community called Poamoliga-Sherigu. This community is about one kilometer (1km) away from the site. Waste dumped in the cells was mixed with plastic and leveled but not compacted as required of a sanitary landfill. Figure 4.9 illustrates the nature of the landfill at Poamoliga-Sherigu in the Bolgatanga Municipality.

Figure 4.9: Landfill at Poamoliga-Sherigu

Figure 4.9 depicts plastic waste management in the Bolgatanga Municipality. The situation at the landfill site shows that, there were no proper measures put for proper plastic waste management and solid waste management in general.

Responses were sought for opinions from a staff of the Environmental Sanitation Unit of Bolgatanga Municipal Assembly (ESU/BMA) on the reasons why there is indiscriminate littering as well as the poor nature of the landfill site in the Municipality. The following were what he said as the consent of the Assembly:

> *...the unit workers frequently sweep and collect plastic waste with other refuse from unauthorized places to the landfill…waste collected is only emptied and leveled at the landfill and sometime, the staff fumigate the landfill to kill insects, flies and mosquitoes in order to protect communities closer to the landfill…the Assembly is supported by the ZoomLion workers to clean most of the public places…some Assembly members sometimes organize their members to come to us for tools to clean their communities (Comments by a staff of ESU/BMA)*

It emerged that, though there were attempts by the Bolgatanga Municipal Assembly, ZoomLion workers and residents to clean public places in the Municipality, the problem of plastic waste still exist. Plastic waste appears to be at all places which could spread diseases and degrades the land particularly farmlands. Plastic waste is non-biodegradable and cannot decompose. This makes them remain in the ground for several years and degrades the land. The situation can also cause low crop production which can affect the local economy.

The findings confirmed what was written by Mudgal and Lyons (2011) that, plastic waste imposes negative environmental externalities. Plastic waste is usually non-biodegradable and therefore can remain as waste in the environment for a very long time. It poses risks to human health as well as the environment and it can be difficult to reuse and/or recycle in practice. Littering of the land with plastic bags and materials presents ugly and unhygienic scene in the urban communities of the country. The indiscriminate littering reduces the rate of rain water percolating resulting in lower level of the water table. Plastic waste left uncollected find their way into water bodies polluting them. Fish and other aquatic animals found in these polluted water bodies swallow the plastic garbage mistakenly as food items and die. Animals that eat plastics sometimes die. Plastics become a nuisance because of their non-biodegradability. Soil fertility deteriorates as plastic bags form part of manure and remain in the soil for years.

In effect, the study found that, effective management of waste especially plastics by the Assembly could minimize the effects of plastic waste on residents' health, floods, air, water pollutions and land degradation. It emerged that, the authorities need to

implement policies that could go a long way to control the problems of plastic waste thereby reducing the effects associated with poor plastic waste management.

4.5 Prospects for Recycling Plastic Waste in the Bolgatanga Municipality

The section sought to explore the prospects for recycling plastic waste in the Bolgatanga Municipality. It indicated the volume of plastic waste generated, types of plastic waste generated, willingness of residents to participate in plastic waste recycling scheme and prospects for establishment of plastic waste recycling factory. It contains observations and interviews conducted with residents, traders and staffs of waste management institutions in the Bolgatanga Municipality.

4.5.1 Volume of Plastic Waste Generated in the Bolgatanga Municipality

The data presents the *volume of plastic waste generated* in the Bolgatanga Municipality. It emerged that, residents, traders and other people mostly use plastic products for their daily activities in the Bolgatanga Municipality. It was observed that, plastic products were found at every corner in the Municipality and the result was the fact that most items sold were partly or fully made of plastic products. Again plastic products were mostly used to parcel and package items sold in the Bolgatanga central market. The items sold included rubber bags, plates, cups, bowls, spoons, stools, chairs, tables, foot wears, toys, among others. Other items at the shops at the commercial center were television sets, wireless sets, computer and accessories, mobile phones, mattresses, rain coats, pipes, tubes, tyres, among others. Again, it was observed that, every household, offices, shops and other public areas were using plastic products for their works and other activities. Despite the importance of adequate use of plastic products, there was large volume of plastic waste generated in the Municipality.

However, observations indicated that, almost all household used plastic products to store water and food stuff, and using them for their daily works. Some of these plastic products were cooking utensils such as bowls and cups and others were household gadgets made with plastics. At the high class residential areas, bins used to collect waste were mostly made of plastic products. These products were therefore disposed off when they were out of use. At public offices, private establishments, shops, restaurants and other public places, plastic waste were seen disposed off in bins for onward collection. At the market, traders were seen gathering sachet rubbers and bottles in sacks and later disposed off them in bins. However, it was observed that, not all this plastic waste was collected to the landfill site. This implies that, there is large volume of plastic waste generated in the Municipality.

Responses were sought from a staff of Environmental Sanitation Unit of the Bolgatanga Municipal Assembly (ESU/BMA) to seek views on the volume of plastic waste generated in the Municipality. The following were explanations which formed the position of the Assembly:

> *...the Assembly has no weighing scale to weigh waste collected on daily bases but uses the standard measurement…the solid waste is not segregated but mixed and so the amount of waste generated daily in the Municipality is about 102 tones…sixty (60%) of the waste generated in the municipality is plastic which means that about 62 tones of plastic waste is generated daily in the Bolgatanga Municipality (Verbatim expression of a staff at ESU/BMA).*

It emerged that, though there is large volume of plastic waste in the Municipality that could be used for other purposes, most plastic wastes were not collected and there were no businesses going on with plastic waste in the Municipality. Therefore, there is the need for the Assembly to seek for support from the private sector, Non-Governmental Organisations (NGOs), benevolent organisations and other

stakeholders who are into plastic waste management to invest into the plastic waste ventures to deal with the problem. This could make resident involve in the collection and recycling of plastic waste generated in the Municipality as done to metal scraps.

4.5.2 Types of Plastic Waste Generated in the Bolgatanga Municipality

The data presents *types of plastic waste generated* in the Bolgatanga Municipality. It shows that, residents consume different types of plastic products thereby generating more plastic waste which are of different types. It was observed that, the types of plastic products consume at homes, shops, offices and at other places were different. It was identified that, majority of the residents used products made of polyethylene such as polythene bags, sachet water and item in rubber bottles; hence generated more plastic waste containing polyethylene products in the solid waste stream. This type of products is relatively cheaper making more people to afford. Meanwhile, polyethylene products are easily worn out and are disposed off once they are not needed.

It emerged from the data that, residents use more polypropylene products than polyamide and polyvinyl chloride products which indicates that, more polypropylene waste were generated than polyamide and polyvinyl chloride products. This could be because polypropylene materials were cheaper than the polyamide and polyvinyl chloride products. Example of polypropylene materials are plastic stools, chairs, tables, and rubber foot wears, among others use at homes. There were however, fewer people who used polyamide and polyvinyl chloride products and could be as a result of the high prices of those products.

However, information on the types of plastic waste generated could not be provided due to the fact that the Assembly had not put measures to make residents segregate the waste before disposal as a result made it impossible to identify the types of plastic

waste generated. It emerged that, the inability of the Assembly to provide data on the types of plastic waste generated in the Municipality and their inability to segregate plastic waste before final disposal, could affect the quality and types of plastic waste for recycling in the Municipality.

4.5.3 Willingness to Participate in Plastic Waste Recycling Schemes in the Bolgatanga Municipality

The data presents *willingness to participate in recycling schemes* in the Bolgatanga Municipality. It emerged that residents were willing to participate in recycling schemes. This was evident when some residents and traders at homes and market were engaged in the plastic waste collection. Sacks full with different types of plastic waste were seen packed expected to be sold to buyers. Scavengers were seen picking plastic waste in sacks expected to be sold to recycler. These indicated that, residents are willing to participate in recycling schemes. However, it emerged from the data that, though residents wanted to participate in plastic waste recycling schemes, they expected enumerations from recyclers in return for the waste.

The researcher sought views from respondents on whether they were ready to sell or give plastic waste free for recyclers. There were several views and one of the residents gave a remark which was the consent of most respondents' contributions:

> *...we are ready to sell plastic waste to recyclers because we have nothing doing and this might supplement our income...some of us are already selling the sachet rubber waste to people and collect money...this sometimes help us to get money and buy to support ourselves...a plastic waste scheme will also encourage the youth without jobs and engaged themselves for an income (Verbatim expression by a resident)*

It revealed that, there was high unemployed and underemployed youth that were willing to participate in the recycling scheme but expect remunerations to support

their incomes. This means that, more people especially the women and children in the Municipality are willing to engage themselves in the plastic waste recycling schemes. This implies that, there is a larger group of people who will be willing to participate in recycling schemes in the Municipality.

4.5.4 Prospects for Establishment of Plastic Waste Recycling Factory in the Bolgatanga Municipality

The data presents, prospects for establishment of plastic waste recycling factory in the Bolgatanga Municipality. It was observed that, residents were already involved in collecting and gathering plastic waste especially the sachet rubbers for sale. Traders who were selling sachet water and those who were selling products in rubber bottles were gathering the empties and selling them to buyers. It was also observed that private individuals were moving from house to house in search of plastic waste to buy. Though, this was in a small scale such that it had little impact on the volume of plastic waste generated in the Municipality, it created awareness on the importance of plastic waste and how people can benefit when engaged in the venture. The money gotten from the sale of plastic waste could be used to supplement income and improve the local economy. However, it emerged that, plastic waste buyers were offering very low prices for huge volumes of plastic waste bought and this was not encouraging enough for more residents to go into the plastic waste venture.

In an interview with a staff at the ZoomLion office to seek views on whether there were prospects for the establishment of a plastic waste recycling factory, the following explanations were expressed which represented the plans of the company:

> *…the ZoomLion (ZL)company has formed kids clubs in most basic schools within the Municipality to collect plastic waste…the kids go round and pick all plastic waste which are later collected and taken to Kumasi, the nearest recycling factory for recycling…the ZoomLion company is making efforts to establish plastic waste recycling factories*

> *in all the regional capitals including Bolgatanga Municipality and to establish recycling schemes to deal with the plastic waste menace…however, the time has not yet come and we are waiting for those at the head office in Accra (Comments made by a staff of ZL).*

Interview was also conducted to a staff of Environmental Sanitation Unit of Bolgatanga Municipal Assembly (ESU/BMA) for views on whether there were prospects for the establishment of plastic waste recycling factory. The following were the comments which represented the general consent of the Assembly:

> *…the Assembly is in collaboration with the ZoomLion (ZL) and is to establish a plastic waste recycling factory in the Municipality to reduce the plastic waste menace in the Municipality and also engage the unemployed youth…plastic waste constitutes about 60% of the solid waste component in the Municipal Solid Waste stream which means that there are plastic waste raw materials available for recycling schemes and to establish a recycling factory…private individuals in the Municipality go round to buy plastic waste mostly sachet rubbers, foot wears, plates, cups and broken chairs and tables, and take them to Kumasi for recycling… though this practice is on small scale business which cannot absorb most of the plastic waste generated in the Municipality, it engages some people in pure water business and the youth thereby reducing their volume (Comments by a staff of ESU/BMA)*

It emerged from the data that, the prospects for the establishment of plastic waste recycling factory lie on residents' and traders' willingness to participate in the recycling schemes. The study revealed that, the people are willing to participate in the plastic waste recycling schemes which implies that, there is available human resource high enough for recycling schemes, hence high prospects for establishment of plastic waste recycling factory. Again, the analysis has shown that, the prospects for the establishment of plastic waste recycling factory also depends largely on the Bolgatanga Municipal Assembly and the private waste management institutions ability to effectively manage plastic waste in the Municipality. This means that, the Assembly needs to implement plastic waste management policies geared towards proper plastic waste management and establishment of recycling schemes and a

factory in the Municipality. This could benefit not only the residents and the Assembly but also improve the local economy in the Municipality.

The findings were similar to what is written by Hagy (2007) that, the benefits of recycling and the ways in which you can participate in recycling are endless. Not only can you save yourself some money by recycling, you can help the environment in a variety of ways. Reducing emissions and greenhouse gases and the use of natural resources but it is also great for the local economy. They are also similar to what Ampofo (n.d) writes, recycling provide opportunities for effective management of plastic waste as well as income generation.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes the outcome of the research, conclusion and recommendations for implementation by all the stakeholders in plastic waste management (Metropolitans, Municipals and Districts Assemblies, Environmental and Protection Agency, private waste management institutions and Health service). The findings in this research will help strengthen evidence base to place of plastic waste management as an important part in managing plastic waste and to link it to healthy life in the country. The findings will help inform its inquiry and ultimately policies regarding plastic waste management and the various stakeholders mandated to ensure good sanitation to deal appropriately with the problems as they occur.

5.1 Overview of the Study

The purpose of the study was to analyse plastic waste management in the Bolgatanga Municipality. The main objective of the study was to; describe plastic waste disposal practices in the Bolgatanga Municipality; examine factors that account for poor plastic waste management in the Bolgatanga Municipality; examine effects of poor plastic waste management in the Bolgatanga Municipality and explore prospects for recycling plastic waste in the Bolgatanga Municipality.

The study employed the descriptive survey research design for the study. The targeted population for the study consisted of residents and traders as well as staffs of the Environmental and Sanitation Unit of Bolgatanga Municipal Assembly (ESU/BMA) and ZoomLion (ZL) waste management Company. The location of the target population was five selected communities in the Bolgatanga Municipality. Sample

size of 250 respondents was employed for the study. Simple random selection, systematic sampling, accidental sampling and purposive sampling techniques were appropriate for selecting the samples for the study. Personal observation was conducted and pictures taken as evidence of the situation. Both primary and secondary source of data were employed to collect information for the achievement of the objectives. The data were analysed to describe and compared the responses of residents, traders and staffs of the waste management institutions on the items on the interviewed guide.

5.2 Summary of the Findings

The research revealed the following:

i. The research discovered that, plastic waste disposal practices were largely depended on residents and traders. It identified that, the popular plastic waste disposal practices in the Bolgatanga Municipality were disposal in open spaces, drains and water bodies. It emerged that, low staff strength and capacity in the Bolgatanga Municipal Assembly resulted to ineffective management of plastic waste in the Municipality.

ii. The research has shown that, the factors that account for poor plastic waste management in the Bolgatanga Municipality included; lack of dumping sites, ignorance on plastic waste management, poverty and non enforcement of environmental laws. It revealed that, the Assembly lacks funds to effectively manage plastic waste in the Municipality.

iii. Also, the research revealed that, the effects of poor plastic waste management in the Bolgatanga Municipality were the spread of diseases, floods, air pollution, water pollution and land degradation. It emerged from the study that, the Assembly's ineffectiveness in waste collection and management

contributed largely to the poor environmental situation on people lives, animals, land and water bodies in the of Municipality.

iv. Again, the research has discovered that, the prospects for recycling plastic waste in the Bolgatanga Municipality were high. It revealed that, the Municipality has large volume of plastic waste with different types of plastic waste generated on daily bases. It also emerged that, residents are willing to participate in plastic waste recycling scheme, hence, there are high prospects for the establishment of plastic waste recycling factory in the Municipality.

5.2 Conclusion

The following conclusions were drawn from the study. To have proper plastic waste disposal practices, there was the need to sensitize and educate residents and traders. Due to the low staff strength and capacity of the Bolgatanga Municipal Assembly which made them ineffective in delivery and provision of poor quality plastic waste management service, amount to the challenges in the Metropolitan, Municipal and District Assemblies in Ghana and developing nations.

On the other hand, inadequacies confronting the Assembly and its private waste management institutions in the Bolgatanga Municipal Assembly were as a result of low capacity, inadequate tools, equipment and machines, lack of funds, non enforcement of environmental laws and many other factors create a huge gap in achieving efficient and effective plastic waste management. It is evident that the problems of plastic waste management still exist in all the communities in the Bolgatanga Municipality even with the involvement of the private waste management institutions. It is therefore a challenge to the Assembly, authorities and policy makers

and implementers to find lasting remedy to the plastic waste situation in the Bolgatanga Municipality and all our urban centers in the country.

It emerged that, the effects of poor plastic waste management that spread disease, causes floods, air and water pollutions and degrades the land resulted in making residents fall sick and sometime loss their lives. It also kills domestic and aquatic animals and sometime lead to low crops yield. These were as a result of the Assembly's inability to enforce environmental laws and to implement policies that can help control plastic waste problems. Authorities need prudent measures including implementing policies to find solutions to the plastic waste problems in the Metropolitan, Municipal and District Assemblies in the country.

Finally, the inability of the Assembly to establish recycling schemes and factories, could be solved through the Assembly efforts to source for assistance from the central Government, private sectors, Non Governmental Organisations and other benevolence societies interested in plastic waste management to help in the establishment of plastic waste recycling schemes and factories to absorb the rapid consumption and increase in plastic waste in the Municipality.

5.3 Recommendations

As a remedy to control environmental problem caused by plastic waste in the Bolgatanga Municipality, the following options could be adopted:

i. The authorities of the Bolgatanga Municipal Assembly should plan and implement sustainable plastic waste management to enhance sensitisation and education to raise residents' awareness on the negative impact of irresponsible plastic waste disposal practices and the need to adopt positive attitude to plastic waste management in the Municipality. Both formal and informal education can

be done with the use of information materials as bill boards, posters, fliers and leaflets distributed among the general public. Again, the staffing capacity of the Environmental and Sanitation Unit of the Assembly should be improved to make them perform their duties efficiently and effectively. Moreover, staff development programmes should be organised for the Environmental and Sanitation Unit of the Assembly to enhance their level of technology in plastic waste management.

ii. Bolgatanga Municipal Assembly in collaboration with the private waste management institutions should create and provide more bins at vantage points and regularly collect the plastic waste at the collection points to the landfill sites to control the level of overflow and littering of areas close by. Additionally, the door-to-door services should be extended to the low class residential areas to minimize littering and dumping of plastic waste in unauthorised dumpsites. It will also minimize the act of burning and burying of plastic waste in unapproved places. Also, the Assembly should provide more tools, equipment and machines including skips, trucks to convey plastic waste to the landfill sites. They should as well initiate, implement and enforce environmental policies and laws that will help reduce plastic waste menace in the Municipality.

iii. Bolgatanga Municipal Assembly in collaboration with the private waste management institutions should regularly remove solid waste particularly plastic waste from the drains to minimize flood cases. Also, they should construct more gutters or drains and cover them in areas that are without drains to prevent people from dumping plastic waste in them. Again, they should regularly fumigate the landfill sites, waste collection points and areas that contain stagnant waters to prevent mosquitoes, insects and flies from breeding and

spreading diseases. Moreover, the Assembly effort to effectively manage plastic waste can lead to the control of air and water pollutions in the Municipality.

iv. Bolgatanga Municipal Assembly in collaboration with the private sector should encourage residents to adapt to the conversion of plastic waste into artifacts such as beads, bags, doormats and hats to reduce the plastic waste problems and to create employment opportunities. Also, the Assembly should make markets available for recycled or reprocessed plastic products to encourage people to engage into such ventures. The Assembly in collaboration with the private sector should establish collection schemes on plastic waste to involve residents in plastic waste management. An enabling environment should be created by the Assembly to encourage residents to participate in plastic waste management. Again, the authorities should motivate Investors with tax relief to encourage them to invest in plastic waste management in the Municipality. Last but not least, the Assembly should seek for support from other organisations interested in plastic waste management to establish plastic waste recycling programmes and site a recycling factory to recycle plastic waste to reduce the level of plastic waste generated in the Municipality.

5.4 Suggestions for Further Studies

Since the study covered only plastic waste management in the Bolgatanga Municipality, additional research is needed to confirm or refute the conclusions of this study. Further studies are needed from different Municipalities and in other areas in order to cover a category of solid waste. This is because plastic waste management plans are different in urban centers; therefore the attitudes of the people may not be the same.

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APPENDIX A

LETTER OF INTRODUCTION

UNIVERSITY OF EDUCATION, WINNEBA	DEPARTMENT OF SOCIAL STUDIES EDUCATION
P. O. Box 25, Winneba, Ghana. ***Tel.*** (03321) 91840 Email: socialstudies@uew.edu.gh	

13th October, 2016

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION: MR. NAAB G. FREDERICK

We write to introduce Mr. Naab G. Frederick to your outfit. He is an M. Phil Social Studies Student with registration number 8150140003 from the above named Department.

As part of the requirement for the award of the master's degree, he is undertaking a research on the topic '***Assessing the Status of plastic waste Management in the Bolgatanga Municipality***'

We wish to assure you that any information provided would be treated confidential.

Thank you.

Yours faithfully,

MARGARET NYALA (MRS.)
for: Head of Department

APPENDIX B

QUESTIONNAIRE FOR RESIDENTS AND TRADERS

UNIVERSITY OF EDUCATION, WINNEBA

ANALYSIS OF PLASTIC WASTE MANAGEMENT IN THE BOLGATANGA MUNICIPALITY

Introduction

This questionnaire is for academic purpose and so you are assured of high confidentiality. It is hoped that you would furnish the research with accurate and necessary information as frankly as you can. Thank you.

Instructions

Kindly answer each question as sincerely as possible by ticking (√) in the appropriate box.

Strongly Agree = SA Agree = A Disagree = D Strongly Disagree = SD

PLASTIC WASTE DISPOSAL PRACTICES

S/N	STATEMENT	SA	A	D	SD
1	I sometimes dispose plastic waste in open spaces.				
2	I sometimes dispose plastic waste in gutters and drains.				
3	I sometimes dispose plastic waste in water bodies				
4	I sometime dispose plastic waste in skips and bins				

FACTORS THAT ACCOUNT FOR POOR PLASTIC WASTE MANAGEMENT

S/N	STATEMENT	SA	A	D	SD
1	I dispose plastic waste at any available places because there are no containers to put them.				
2	I dispose plastic waste at any available place closer.				
3	I dispose plastic waste at any available places because I cannot afford to pay for waste collection.				
4	I put plastic waste at any available place because there are no laws preventing me.				

EFFECTS OF POOR PLASTIC WASTE MANAGEMENT

S/N	STATEMENT	SA	A	D	SD
1	Poor plastic waste management can spread diseases.				
2	Plastic waste dispose in drains can cause floods				
3	Plastic waste burning can cause air pollution.				
4	Plastic waste dispose in water can cause water pollution.				
5	Plastic waste litteringcan degrade the land				

APPENDIX C

FACE-TO-FACE INTERVIEWS WITH RESIDENTS AND TRADERS

PLASTIC WASTE DISPOSAL PRACTICES

1. What is the plastic waste disposal practices use in the community?

   Prompt: How many communal skip or bins are in your community?

   How do you dispose of your plastic waste?

   Which areas do you dispose of your plastic waste?

FACTORS THAT ACCOUNT FOR POOR PLASTIC WASTE MANAGEMENT

2. What are the factors that account for poor plastic waste management?

   Prompt: How frequent do you use plastic products?

   Do you pay for plastic waste disposal, if not why?

   How often do the authorities come to collect your plastic waste?

   Are people punished when they do not handle plastic waste well?

EFFECTS OF POOR PLASTIC WASTE MANAGEMENT

3. What are the effects of poor plastic waste management?

   Prompt: How can plastic waste cause the spread of diseases?

   How can plastic waste cause floods?

   What are the activities of man that can cause air pollutions?

   What are the activities of man that can cause water pollution?

   What other activities can you do to have negative effects on the land?

4. Will you participate in plastic waste recycling schemes?

   Prompt: How will you participate in plastic waste recycling schemes?

APPENDIX D

FACE-TO-FACE INTERVIEWS WITH STAFFS OF WASTE MANAGEMENT INSTITUTIONS

PLASTIC WASTE MANAGEMENT

1. What types of plastic waste management practice are used in the Municipality?

   Prompt: How do you collect plastic waste in the community?

   How many bins are there to collect plastic waste?

   How many times do you collect waste from collection point?

   What happens to the plastic waste at the landfill site?

   What other methods do you use to manage plastic waste?

2. What method(s) are used to treat plastic waste in the Municipality?

   Prompt: What other methods are used to control plastic waste generated?

   What methods are used to involve residents in plastic waste management?

3. What by-laws are use to sanction people for effective management of plastic waste?

   Prompt: What do you do when there is outbreak of diseases or flood cases?

   What do you do to protect animals consuming plastic waste?

   How do you control the burning and burying of plastic waste?

4. What are the prospects for recycling plastic waste in the Municipality?

   Prompt: What is the volume of plastic waste generated in the Municipality?

   What are the types of plastic waste generated in the Municipality?

   What are theplastic waste recycling schemes used in the Municipality?

   What are the plans towards recycling plastic waste in the Municipality?