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# Assessing Effects of Polythene Waste on the Urban Environment in Bungoma Town, Kenya

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**ABSTRACT**

Globally, the urban environment faces many threats, of which polythene waste is also among key ones. This research project aimed at assessing the effects of polythene waste on the urban environment. The study was carried out in Bungoma town, Kenya. Bungoma town is located in Bungoma county, also serving as the headquarter of the county and Bungoma south sub-county. The purpose of the study was to assess effects of polythene waste on the urban environment in Bungoma town Kenya with the view of eliminating or reducing its negative effects. This research project was guided by the following objectives: to establish the sources of polythene waste on the urban environment in Bungoma town, to evaluate the effects of polythene waste to the urban environment in Bungoma town and to identify optional management approaches of polythene waste other than the EMCA, (2017) ban on the urban environment in Bungoma town. The study applied descriptive survey research design. The target population was 17,274 with a sample size of 375 people. Stratified sampling technique was employed whereby business people, residents, officers from NEMA, public health and environment, water and natural resources were be placed in different strata. Random sampling was used to select individuals. Snow ball sampling was also used to sample individual home owners. Data was collected using questionnaires and interview schedules and data was analyzed using measures of central tendency and SPSS. The analyzed data was then presented through tables, Pie Charts and graphs. Validity of instruments was taken care by supervisors and other experts in the field of Geography, while reliability of the instruments was tested through a pilot study and test pre-test of the instruments. The study results will be significant to town planners, policy makers like NEMA and town residents on waste management mechanisms, especially polythene. The study will also be a basis for further research in the field of Geography, Health, Environmental studies among others. Ethical issues of concern were privacy and confidentiality, informed consent, anonymity and researcher's responsibility. Findings from the study established that sources of polythene waste come from household or domestic waste from residential areas, industries, commercial institutions like supermarkets, wholesale and retail shops, institutions like schools, both private and public and finally other open air businesses. The study also established that negative effects of polythene waste are blockage of drainage channels, production of harmful gas when burned, a hazard to children, reduction of soil fertility, fatal to animals, they are non-biodegradable, are breeding grounds of vectors like mosquitoes, unending in the environment and cause

cancer. For management of polythene waste, the study established use of biodegradable papers, involving of the local community, re-use and recycling, proper education, burning by use of incinerators, and enforcement of laws and legislations. This study recommends that NEMA and the ministry of environment are required to intensify their efforts to increase awareness of the public through formal and informal education about the importance of caring about the environment and the dangers of polythene waste, manufacturers, supermarkets, wholesale and retail shop owners should be held responsible for their behavior with respect to the distribution and disposal of polythene waste, in line with the polluter pays principle. Bungoma town waste management strategy should contain waste separation at source to make sure that actors within the recycling chain are guaranteed of less contaminated waste. Manufacturers and commercial institutions, which handle bigger quantities of polythene waste should be facilitated to form associations so as to consolidate their waste for recycling.

**Keywords:** Polythene Waste, Urban Environment, Waste Management, EMCA-Environment Management and Co-Ordination Act, NEMA-National Environment Management Authority

## 1. INTRODUCTION

### 1.1 Background to the study

Eradication of polythene waste for a clean environment is paramount for everyone around the world. Basically, their eradication is intended to make the environment clean and void of pollution. The Constitution of Kenya, (2010) gives a number of provisions about a clean environment. Environment provisions are included in Chapter Four under Rights and Fundamental Freedoms, Chapter Five under Environment and National Resources and Chapter Ten under Judicial Authority and Legal system. The fourth schedule also includes environmental provisions under Distribution of functions between National and County Governments and the Fifth schedule titled Legislation to be enacted by parliament.

The Environmental rights and freedoms contained in Article 42 of the constitution, protects the rights of an individual to a clean and healthy environment. This therefore implies that the environment has to be protected for the use of the future generation and its utilization should be in a sustainable manner. Therefore the parliament should develop laws that will guide in the sustainable utilization of the environment by the present and the future generation. Specifically they should operationalize the articles 69 and 70.

On the laws governing the environment, Article 72 give the parliament the powers to enact laws that will operationalize the provisions within the constitution that talks about the environment

In the spirit of protecting the environment, the cabinet secretary for Environment and natural resources Professor Judi Wakhungu put an official gazette notice in February 28, 2017, to illegalize the manufacturing and importation of all bags made from plastic that are used in all sectors of the economy including the household as from August 2017.Therefore, taking care of the environment is very important and there is no shortcut about it. This calls on all people to be mindful and careful when interacting with environment.

In the world today polythene waste is a major challenge whose management is an issue that has not been addressed to its fullness. In the United States of America polythene waste is still a challenge. Jacob and Arleton, (2012) alludes that management of polythene waste is a challenge. They record that for many years biologist dealing with organisms in the ocean and those doing research in the ocean have seed a significant increase in the quantity of gabase originating from plastic bags inside ocean waters and on

land. The San Francisco Chronicle Newspaper December 15th (2010), Emily Utter of the Bag It Team says the state had to ban plastics because of their immense danger to mankind and the environment. Marcus Klaretal, (2014) records the alarming spread of waste from chemicals and plastics both on land and in the ocean which have the potential of transporting with it some species that are not friendly to the organisms living in water environment. According to estimates, there is at least 100-200 million tonnes of plastic in the oceans of the world, most prominent of all contamination being plastic at around 60-90%.

In Africa Rwanda was among the first countries to ban polythene material use. According to Rwanda Environment Management Authority (REMA, 2008) the government of Rwanda through the ministry in charge of environment carried a scientific study on the effect of waste made of plastic waste on environment within Rwandan and their contribution on the economy. The study showed an over whelming negative impact on the environment which led the government to ban plastic bags. According to the UN,(2008) the capital of Rwanda Kigali got the UN Habitat award of honor for innovations on improved garbage collection specifically polythene waste.

In Kenya, Ong'uya et al, (2014) in a study about the plastic menace in Nairobi City at Dandora, revealed that the dumpsite was full of plastics which are a real challenge to the city of Nairobi.

In Bungoma town one is able to notice littering polythene waste which is caused by poor framework in the collection of waste from solid. By the beginning of the year 2018, Bungoma town is in tire need for the management of waste from solid, polythene waste included. The county government tries but its efforts are still far behind any good results in terms of eradication of polythene waste from the town.

Bungoma town is the headquarter of Bungoma county. It is also a good market center for agricultural produce and other businesses also thrive very well. The town lies between latitude 00281 and latitude 10301 north of the Equator and longitude 340201″ East and 350151″East of the Greenwich Meridian. The major sources of solid waste generation in Bungoma town are: household waste or domestic from residential areas, commercial establishments like shops and restaurants and institutions like schools, colleges, and government and private offices. Some previous studies in Bungoma town on solid waste were carried out in August 2012 by Equatorial Lakes Subsidiary Action Program Annex3A.They confirmed that these were major sources of solid waste.

**1.2 Statement of the problem**

Polythene waste has adverse negative effects on the urban environment. According to UN (2008) the capital of Rwanda, Kigali got the UN Habitat award of honor for innovations on improved garbage collection specifically polythene.The efforts of alleviating polythene waste in Rwanda made Kigali town and the rest of the towns in the country clean hence making the urban environment clean and healthy with a very good aesthetic value. However, according toAnnex3A, (2012) Bungoma town faces the problem of polythene waste given the research carried out which revealed that solid waste management is done collectively which has not dealt exclusively with polythene waste. As a result polythene waste still poses problems given its negative effects like blockage of drains which cause flooding when it rains, bad scenery due to plastics and a health hazard to animals for farmers in the town. Polythene waste being part of the bulk solid waste in the town is mainly disposed of by open dumping method which poses the problem of blocking the drainage for the storm water by plastics; burning the plastics in the open air pollutes the air by its smoke within the town environment and littering polythene in open dumpsites destroys the aesthetic view of the town.

### 1.3 The purpose of the Study

The purpose of the study was to assess effects of polythene waste on the urban environment in Bungoma town, Kenya with the view of eliminating or reducing its negative effects.

### 1.4 Justification of the Study

The previous studies mostly dealt with general solid waste management in Bungoma town but not exclusively polythene waste. Apart from that despite current efforts to curb the problem, it still persists. This consolidates the justification of the study on assessment of effects of polythene waste on the urban environment in Bungoma town. The current ban on plastic papers only covers flat bags and carrier bags exclusively and not a blanket ban on all polythene.

## 2.LITERATURE REVIEW

### 2.0 Introduction

This chapter helped to review the literature based on environmental effects of polythene waste .It also focused in detail on the sources of polythene waste, effects of polythene waste and the optional management approaches to polythene waste other than the EMCA (2017) ban. It also covered with the empirical review, conceptual framework, theoretical framework and the research gap.

### 2.1 Empirical Review

Plastics are important in our society and offer many benefits for human health and the human environment (Plastics Europe 2009 and Neal 2009).It is due to the many uses of plastics that the many environmental effects of plastics are felt in the urban environment. These waste generated from plastics will spread all over the environments within land and even find their way to the water bodies. The concern is that there are large volumes of these waste form plastic growing at an alarming rate deposited on top of the ocean, land surrounding the ocean, in soils under the ocean and small pieces of plastic are also found land along the cost and in sediments (Barnes et al 2009, Thompson et al 2004).Bangladesh a developing country faces growing challenges in its urban centers due to plastic pollution. The population of Bangladesh is above 150million with a growth rate of 1.3% (Marcus et al 2014).Urban areas in Bangladesh generates 17,000 tonnes per day of which plastic is about 2500 tonnes. According to the city cooperation in 2005 the total urban waste generated was13500 tonnes per day and plastic waste ratio at 5.1%.General growth of waste generation has increased by5.2% per year, but plastic waste by 7.5%.According to NEMA, (2015), the current situation of plastics in Kenya is still wanting given few efforts towards solid waste management, especially on waste segregation. There is a research gap where by a study carried by Annex 3A, (2012) for Bungoma town and Lwakhakha market, which dealt in general with solid waste but not polythene waste exclusively. The expectations are that the research findings will input in the unlocking of polythene waste issues in Bungoma town.

### 2.1.2 Effects of Polythene Waste

The International Journal of Environmental Sciences Vol: 2(3) 6-10 March (2013), a number of effects of polythene waste are addressed. They include blockage of drains, effect on soil fertility, impacts on Wildlife and unpleasant scenery.

**Blockage of drainage channels ditches and Gutters**

This is a common effect associated with Polythene Waste. According to EPHC (2002), Polythene waste leads to blockage of drainage which also affects sewage lines because of the excessive water flow. The effluent from the sewage lines leads to disease outbreaks like cholera, dysentery and bilharzia which are

detrimental to the health of the residents or mankind. This may also lead to widespread flooding. In 2002 Bangladesh banned the use of polythene bags because of the floods which will heavily experience in 1988 and 1998.

**Plastics are fatal to both land and water animals**

Ikiara et al (2004), mentions that plastic waste leads to death of animals, both terrestrial and aquatic. When land and water animals ingest them they cause illness which later leads to death. Domestic animals like cattle when they consume plastics, they is indigestible. As a result they remain in the alimentary canal hindering the digestive process and they later die. Aquatic animals like fish die because of the polythene bags indigestibility.

**Polythene waste act as breeding grounds for vectors.**

The vectors include insects like mosquitoes which are disease causing organisms. The International Research Journal of Environment (2013),point out that Polythene waste act as breeding place for various disease carriers like the deadly Anopheles Mosquito that spreads Malaria. They also keep the Cholera germ. Stagnant water on plastics is a predisposing factor for keeping the germs for the vectors. As a result malaria menace is rampant because of these vectors. On the other hand, small marine species such as hydroids and crabs stick on plastics and is transported by ocean currents to new locations. As a result they change the ecological systems of new found environments. However, even if the vectors thrive in the stagnant waters on plastics, there lifespan is short and they do not survive all through in all weather conditions due to either extreme hot or very cold temperatures.

**Polythene bags are carcinogens**

Med lexicon international medical news today (2015), alludes that Polyps which include plastics that cause Cancer.However, these adenomas are normally taken rid of during colonoscopy. Hyper plastic polyps likewise have the potential of causing cancer but they rarely form cancer cells. Another cause of cancer are inflammatory polyps when the colony is inflamed. Polythene is linked with cancer of the colon. When polythene bags come in contact directly with food in packaging chemicals within the polythene bags can leach out into food and contaminate it. As a result one can be a victim of cancer unknowingly just because polythene bags will used in the packaging of the goods used. However, plastics are not the only likely causes, there is a DNA type, Family type, habitual or diet type and medical factors like diabetes.

**Polythene bags are non-biodegradable**

According to Delilah, (2011) in her Thesis in Environmental Science many waste from plastics will stay for avery long time in the environment and have a very low biodegradability. Polythene does not easily decompose or breakdown by action of bacteria to get them extinct in the soil or become manure. It instead it is whole in the form of the strands as it was made in terms of shape. They as a result are a big menace. Even if they are divided into many parts, they still remain whole and the little traces remain intact. An organic chemist by the name Kenneth Peters from the university of Stanford University (2011)argues that microorganism have the ability to break down polysaccharides into sugars very fast, they can also break down wood but can not break down carbon- carbon bonded polypropylene. Manufacturing of plastics which is a product of petroleum turns it into unrecognized material by the organisms that normally break down matter. If scientists made plastics that would biodegrade through peptide bonds they would have a short shelf life. Potential sources of distribution of plastic chemicals to the environment include the following: waste water, sludge from sewage treatment plants, leakage from landfills, Incineration fumes, Local, regional and global transport of chemicals from plastic waste.

**Polythene waste is unending in the environment**

A report on Municipal Solid Waste Generation Recycling and Disposal in the United States (2009), indicate that polythene bags can be easily thrown because they are light in weight. As a result they are unending in the environment, hence become a menace that does accelerate day in day out as if they are in a recycling process from stage of use to the environment. However, with proper strategies at waste collection points like sorting and proper waste disposal polythene waste will be a thing of the in the environment. Polythene bags could be used as mobile toilets and general household disposal methods, which may be thrown carelessly. These could be prevalent in slums around towns where a great number of residents here are poor who may not access social amenities like sewage facilities and proper toilets. Many residents in slums like, Nairobi's Mathare and Kibera, may be tempted to adopt this method for human waste disposal and other domestic waste such as household waste. This may be accelerated by poor housing, congestion and lack of proper facilities for waste disposal. Excreta thrown in the open environment shall pose danger of diseases and unhygienic roads and the general environment. It propagates diseases like bilharzias, dysentery and diarrhea. Polythene waste destroys beautiful scenery. Polythene bags come in different colors and different sizes and shapes. They are blown to fences, grass, trees and flowers. They destroy the aesthetic value of the environment where it is supposed to be beautiful and inspiring to the eyes for a serene environment of tranquility. Polythene bags bother the eyes on the beautiful lawns, parks and streets flowers.

**Loss of soil fertility**

According to the Farmers Voice (2014) polythene waste block water penetration in the soil, they lead to poor aeration and drainage in the soil. Plant roots have a hurdle of penetrating through polythene bags layers in the soil for water and tapping of nutrients in the soil. Polythene bags prevent water into all layers of the soil. Hence decomposition in the soil is hindered because of non-uniform circulation of water and air into the soil. As a result fertility is not achieved which result into low yields in agriculture products because of the low fertility in the soil as a result of polythene bags. When polythene waste decomposes they deposit chemicals into the soil and water bodies. In the event of decomposition they release deposits of petroleum chemicals to the environment; causing pollution. Petroleum is the raw material for manufacturing plastics. On the overall the soil will not forth yields as expected, due to plastic remains present.

**Polythene are a hazard to children**

Eco-Healthy Child Care (2010) are of the view that some plastics have been found out to have chemicals that are toxic and have a very big effect to the health of human beings. Small kids have a habit of putting plastic bags into their mouth and run a great risk of suffocation.Phthalates and Bisphenol chemicals are used to make bottles and cups that are used by babies. They also make other accessories to the bottles and cups like rings used for teething by children and Sippy cups. The two ingredients in the bottle and cups used by babies produce some chemicals which imitate estrogen and testosterone hormones giving a lot of worries to the researchers as they are suspected to affect the normal growth and development of the children. They are worn as play masks and as a result cause children to suffocate especially the much younger ones who lose enough air and they die eventually.Polythene bags used to wrap toxic substance like chemicals and drug, both veterinary and human is dangerous as play toys to children. Inhaling the chemical residues from the polythene bags cause suffocation to young ones who innocently use the polythene bags during play. (Yam, K. 2009).

**Polythene produce toxic fumes**

Nova Chemicals Corporation (2012), indicate that when one comes into contact with melting materials from polythene will get server external burning which could result into permanent effects and even cause people to be blind. When one inhales smoke from the burning polythene could cause some hazardous effect. Polythene materials are made of petroleum products whereby when they burn they pollute the air by producing dirty smoke in the atmosphere and the environment as a whole.

Petroleum products from which polythene bags are made, Lead is one of the compounds which has long residual effects whereby it affects human health when consumed through products like vegetables which is detrimental to human health.

## 3. RESEARCH METHODOLOGY

### 3.1 Introduction

In this chapter, the research methodologies that were used are as described. This section also described the research design, location of the study, target population, sample and sampling techniques, data collection instruments, validity and reliability of research instruments, pilot study, research collection procedures, methods of data analysis , presentation and ethical consideration

### 3.2 Research Design

This study was done based on design of the research called descriptive Survey. The design has an orientation method that can be used or investigating the populations through selection of samples to be analyzed so as find to out the occurrences. This design is concerned with how economical the design is for the study, how fast data can be collected and if the design has the ability in helping the researcher understand the population under study and the design can also help in doing research in an extensive manner (Oso and Onen, 2009). According to Bungoma county revenue collection, environment ,water and natural resources, Public health, planning ,IEBC and NEMA departments, the target population was 17274 which encompassed 13556 business people,3466 residential homes,172 officers from water and natural resources ,63 officers from environment ,12 officers from public health and 5 officers from NEMA.

The sample size was 375 from the target population of 17274. The Krejcie and Morgan table was adopted, according to The NEA Research Bulletin, vol.38 (December, 1960), p.99. The table in appendix 6 shows the Krejcie and Morgan table for sample size.

## 4. RESEARCH FINDINGS, ANALYSIS AND PRESENTATION

### 4.1 Introduction

This chapter presents research findings, analysis and presentation. The purpose of this study was to assess effects of polythene waste on the urban environment in Bungoma town, Kenya. The study was organized based on the objectives of the study including sources of polythene waste on urban environment, effects of polythene waste on urban environment as well as assessing optional management approaches to polythene waste other than the (EMCA 2017) ban . The responses were analyzed into frequencies, percentages, mean and standard deviation and presented in tables and graphs.

### 4.2 Response Rate

The respondents involved were business people, town residents or home owners, NEMA officer, Public health officer and ministry of Environment, water and natural resources officers. They returned the questionnaires and interview schedules which are as tabulated in Table 2.

**Table 1: Instrument return rate**

| Respondents | Sampled size | No. collected | Return rate (%) |
|---|---|---|---|
| Business People | 290 | 240 | 82.8 |
| Residential homes | 81 | 65 | 80.3 |
| NEMA | 1 | 1 | 100 |
| Public Health | 1 | 1 | 100 |
| Environment, Water and natural resources | 2 | 2 | 100 |
| **Total** | **375** | **309** | **-** |

### 4.5 Effects of Polythene Waste

The second objective of the study was to evaluate the effects of Polythene waste on the urban environment in Bungoma town. Respondents were asked to give some negative effects of polythene waste in the town. Findings are presented in Table 5.

**Table 2: Respondents Opinion on Negative Effects of Polythene Waste**

| Effects of Polythene Waste | Frequency | Percentage |
|---|---|---|
| Polythene bags cause suffocation to children | 9 | 2.9 |
| They produce harmful gas while burned | 68 | 22.0 |
| Blockage of drainage channels ditches and Gutters | 112 | 36.3 |
| Loss of soil fertility | 41 | 13.3 |
| Water borne diseases | 22 | 7.1 |
| Plastic waste leads to death of animals | 53 | 17.2 |
| Plastics cause Cancer | 4 | 1.3 |

**N=309 309 100**

The results in Table 5 show that (36.3%) of the respondents opined that polythene waste cause blockage of drainage channels, (22.0%) indicated that polythene waste produce harmful gas while burned, (17.2%) were of the opinion that polythene waste leads to death of animals, (13.3%) indicated that polythene waste cause loss of soil fertility, (7.1%) opined that polythene waste cause water borne diseases, (2.9) indicated that plastic waste leads to suffocation of children and (1.3%) of the respondents opined that plastics cause cancer. Findings from the questionnaires and interview established the negative effects polythene waste as blockage of drainage channels, produce harmful gas, suffocate children, reduce soil fertility and kill animals.

Respondents were also asked to tick on the negative effects of polythene waste in Bungoma town. Findings are presented in Table 6.

**Table 3: Negative Effects of Polythene Waste**

| Effects of Polythene Waste | Frequency | Percentage |
|---|---|---|
| Block ditches, drainage channels and gutters | 106 | 34.3 |
| Do not decompose | 69 | 22.3 |
| Breeding grounds for vectors like mosquitoes | 4 | 1.3 |
| Produce toxic fumes when | 41 | 13.3 |

| | | |
|---|---|---|
| burned | | |
| Kill land and water animals | 34 | 11.0 |
| Polythene waste are unending in the environment | 26 | 8.4 |
| Hazard to Children | 4 | 1.3 |
| Loss of soil fertility | 23 | 7.4 |
| Causes cancer | 2 | 0.7 |
| **N=309** | **309** | **100** |

Findings in Table 6 show that (34.3%) of the respondents ticked on block ditches, drainage channels and gutters as an effect of polythene waste, (22.3%) indicated that polythene waste do not decompose, (1.3%) were of the opinion that polythene waste create breeding grounds for vectors like mosquitoes, (13.3%) indicated that polythene waste produce toxic fumes when burned, (11.0%) indicated that polythene waste kill land and water animals, (8.4%) indicated that polythene waste are unending in the environment (1.3%) indicated that polythene waste are a hazard to children, (7.4%) indicated that polythene waste cause loss of soil fertility and (0.7%) of the respondents were of the opinion that polythene waste causes cancer. This implies that polythene waste have various adverse effects on the environment of Bungoma town. EPHC (2002) reported that polythene waste leads to blockage of drainage which also affects sewage lines because of the excessive water flow and Ikiara et al (2004) mentioned that plastic waste leads to death of animals, both terrestrial and aquatic.

Respondents were further asked to indicate the level of polythene waste negative effect in Bungoma town. Findings are presented in Table 7.

**Table 4: Level of Polythene Waste Negative Effect**

| **Level** | **Frequency** | **Percentage** |
|---|---|---|
| Very high | 189 | 61.2 |
| High | 68 | 22.0 |
| Moderate | 37 | 12.0 |
| Low | 15 | 4.9 |
| Total | **309** | **100** |

Source: Researcher (2018)

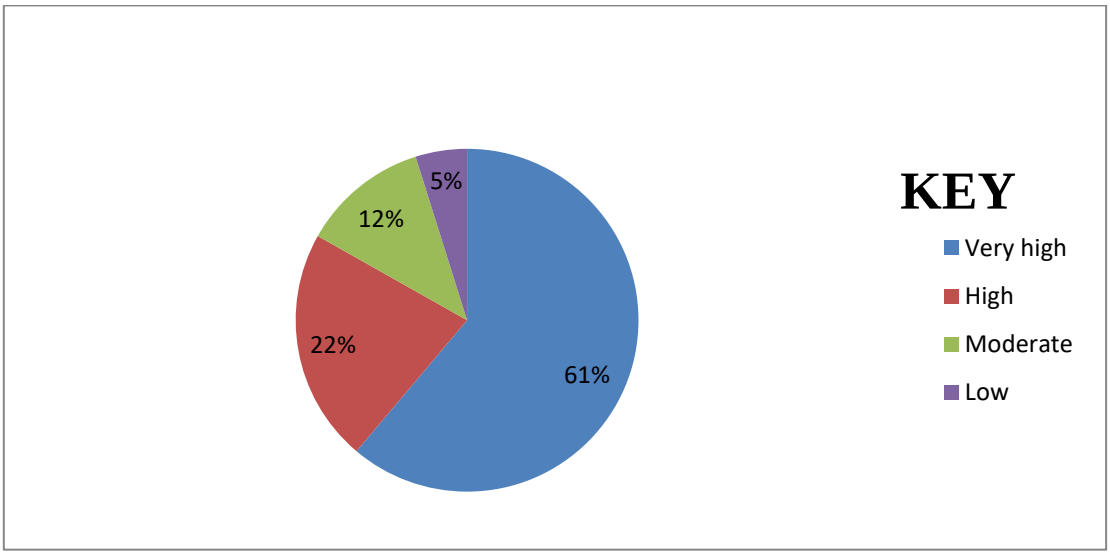


**Figure 1: Level of Polythene Waste Negative Effect**

Results in Table 7 and figure 8 show that majority of the respondents (61.2%) indicated the level of polythene waste negative effect as very high, (22.0%) indicated high (12%) indicated moderate and (4.9%) of the respondents indicated the level of polythene waste negative effect as low.Findings from the field by observation revealed that some plastics were being burned hence foul smell, some were lying in stagnant water, hence a potential breeding ground for vectors and some were spilling in agriculture gardens posing a danger to soil fertility.

## 5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Introduction

This chapter presents a summary of the major findings of the study and giving conclusions which attempt to give answers to specific questions that were investigated. It also presents recommendations for possible actions and suggestions for future research.

### 5.2 Recommendations

Based on the findings the study recommends that:

NEMA and the ministry of environment are required to intensity their efforts to increase the awareness of the public through formal and informal education about the importance of conserving the environment and the dangers of polythene waste

Manufacturers, supermarkets, wholesale and retail shop owners should be held responsible for their behaviour with respect to the distribution and disposal of polythene waste, in line with the polluter pays principle.

Bungoma town waste management strategy should contain waste separation at source to make sure that actors within the recycling chain are guaranteed of less contaminated plastic waste.

Manufacturers and commercial institutions that handle bigger quantities of polythene waste should be facilitated to form associations so as to consolidate their waste material for recycling.

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