COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

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ASSESSMENT OF SOLID WASTE MANAGEMENT PRACTICES: IN THE CASE OF BEKUR SUB-CITY, WOLKITE TOWN, GURAGE ZONE, SNNPs

SENIOR PROJECT SUBMITTED TO DEPARTMENT OF BIOLOGY FOR PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR OF SCIENCE IN APPLIED BIOLOGY

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ABSTRACT

Solid waste refers to the range of garbage arising from animal and human activities that are discarded as unwanted and useless which is generated from industrial, residential and commercial activities in a given area, and may be handled in a variety of ways. The research has focused on examining current status, the performance of municipal solid waste management practice of the Bekur sub city wolkite town. Both quantitative and qualitative sampling methods were employed through primary and secondary sources. *A survey was conducted on 96 householders and interviews with the head of environmental protection sector office. The collected data was analyzed by using Microsoft office excel and presented in the form of table, graphs, and percentage. The findings of this study revealed that the present system of solid waste disposal management in Bekur-sub-city, Wolkite town entirely relied on the municipality which provided the full range of waste collection, transportation and disposal. Nevertheless, the provision of this service is not kept in pace with the town solid waste generation rate. Based on the findings of this research, the compositions of the households' solid wastes were khat litter (66.66%), plastic bags (30.00%, and others (3.44%). Therefore, the best ways that used to tackle the aforementioned problems are: execution of sustainable solid waste management systems (reuse, recycle, composting, and incineration) through awareness creation and training, improvement of institutional structure and capacity, and implementation of integrated municipal solid waste management approach which recognizes and comprises all stakeholders.*

Key Words: Assessment, Bekur sub city, Management, Solid, Waste.

1. INTRODUCTION

1.1. Back ground of the study

Waste management (or waste disposal) is the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. Waste is something that is left over or that is no longer needed. Waste can be solid, liquid, or gaseous and each type has different methods of disposal and management. Waste management deals with all types of waste, including industrial, biological and household. In some cases waste can pose a threat to human health (**UNSD, 2017**). Waste is produced by human activity, for example the extraction and processing of raw materials (**IFC, 2014**). Waste management is intended to reduce adverse effects of waste on human health, economic development, and the environment aesthetics (**UNEP, 2013)**

Global production of municipal solid waste is expected double in the next 15^{th} years. This increment is primarily attributable in the developing countries driven by the combined effects of strong urban growth and economic development. Increment of wastes in volume also represents economic challenges. Every year developing countries spend 46 billion. USA managing their municipal solid wastes and this improvement could exceed USA 7150 billion per year by 2025. Most of the solid wastes are disposed on the land in open dumps. Disposal of solid wastes on the land without careful planning and management can present danger to the environments, economy and health. Solid waste includes papers and cardboard glass, metals, plastics and textiles **(Sha Ato *et al*., 2007**). These are also generated by commercial and industrials organization. Also large volumes of chemical mineral wastes are produced in additional depending on sectors (**Sharholy *et al*., 2008**).

Inadequate municipal solid waste collection and disposal creates environmental problems. Considerable amounts of wastes ends up to open dumps and drainage system can threatening both surface and ground water salinity and provide breeding around for disease carrying pests (**Barton *et al*., 1994**). Most of local government and urban agencies have time and again, identified solid waste as major problem that has reached proportions requiring drastic measures. We can observe three key trends with respects to solid waste, such as increase in sheer volume of waste generated and disposal method and management's practices of the collected wastes inciting land fill incretion. (**Sango, 1993**)

1.2 Statement of the problem

The sources of municipal solid wastes are sewage wastes, Industrial wastes and agricultural pollutants. These solid wastes have been becoming a major problem in the town and surroundings small land scale owner farmers. It has a potential to threat public health, pollutes the environment and blocks the economic development of an area because of the negative images it creates among investors/visitors. Therefore it needs common and combined efforts of the responsible bodies like individuals, professionals, politicians, administration, labors, and merchants to bring a well-defined result on the town solid waste disposal. So this finding was conducted to increase practice of solid waste management, and mainly aimed to assess practice of solid waste management in Bekur sub city.

1.3. Objectives

1.3.1 General objective

To assess practice of solid waste management: on Bekur sub city, Wolkite Town.

1.3.2 Specific objectives

- ✓ To identify the sources and types of municipal solid waste disposal at the study area.
- ✓ To assess the effects of municipal solid waste at the study area.
- ✓ To identify the management strategies to solve the problem related to municipal solid waste disposals.

1.4. Significance of Study

The study provides insight information extent for other researchers, who would like to undertake the research in the surround areas of the Town. It is serve as reading document for the researchers. We hope that it will encourage various stakeholders' workings in the area to revise their activities and action for the proper sewage disposal mechanisms. It will give awareness about the problem that caused by solid wastes in surrounding community.

1.5. Scope of the study

The study is attempted to assess the effects, source, and management route of municipals solid waste on the surrounding communities by selecting Wokite town, Bekur sub city for the study site. Even if the impact of solid wastes is common all over our country, the study was limited to Wolkite town specifically Bekur sub city, because there is the limitations of shortage of time, financial problem, lack of materials computer laboratory and lack of sufficient experience in conducting research.

2. LITERATURE REVIEW

2.1 Municipal Solid Wastes

Municipal solid waste is becoming a major public health and environmental concern in urban areas of many developing countries. The improper management of solid waste results a source of environmental pollution and possesses risk to human health (**EPA, 1994**).

Municipal solid waste in most cities contains human and animal excreta, hazardous (chemical pollutants which can facilitate the spread of disease and injury particularly among children playing near waste dump sites and employees in waste management sector). Poor disposal of solid waste are associated with spread of vector born disease (**Barton *et al.*, 1994**).

Solid wastes vary greatly from municipality (country to country) and change significantly with time. In municipalities which have a well-developed waste recycling culture, the waste stream consist of mainly intractable wastes, such as plastic film, and unrecyclable packaging maternal (**Barton *et al.*, 1994**).

2.2 Types of Municipal Solid Waste

Municipal solid waste refers to any non-liquid waste that is created by an individual person, house hold, small business such as a school and hospital, manufactories, and industries. This type of waste is commonly called trash or garbage and includes everyday items or things that are broken, food that has spoiled, or simply any item no longer needs or wants. The most common items disposed as municipal solid waste are paper, yard trimmings, food, plastics metals, rubbers, leftover khat, and textiles (**IFC, 2014)**. The following are the most common waste disposal creating cases in the environment; biodegradable waste disposal, recyclable materials, inserts waste electrical and electronic waste, composite wastes and hazardous (**Sha Ato *et al.*, 2007**).

2.3 Source of Municipal solid Wastes

There are several sources of solid waste start from an individual person to higher industry. For example domestic solid waste, commercial solid waste and industrial solid waste which is generated by all industries, chemical waste or other special waste (**Sha Ato *et al.*, 2008**).

2. 4 Effects of Municipal Waste Disposal

Waste disposal are the activities or actions that required to managing waste. Normally these activities are including the collection and transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. Following the onset of industrialization and the sustained urban growth of large population centers, the build-up of waste in the cities caused a rapid deterioration in levels of sanitation and the general quality of urban life. The streets became choked with filth due to the lack of waste clearance regulations (**Hebert and Lewis, 2007**. If those method of managing solid waste properly done, it can reduce the problems that caused by improper solid waste disposal such as environmental pollution, health risk, decreasing economic development and spurred by increasingly devastating cholera (**Hebert and Lewis, 2007**).

When solid waste, from food leftovers to chemical by-products from manufacturing, isn't discarded properly it can have far-reaching consequences for the environment and its natural vegetation and inhabitants, as well as for public health. (**Sha Ato *et al*., 2007**).

2.4.1 Environmental effects

Hazardous gas emissions ; in 1987 the EPA estimated that the nations of 124 landfills emitted 15 million ton of methane per year and 30,000 ton of other gases like toluene and methane chloride (Philips,1998). As mentioned earlier in the report, methane is powerful greenhouse gas and landfills contributed 23% of total emission in 2006 (**USAPA, 2008)**. In addition to its effect in the ozone layers, methane is also a highly combustible gas that may be responsible for various explosion hazards in and around landfills (**Abarca *et al.*, 2013**).

Producing algal biofuels could harm water quality depending on the resource input and management used in algae cultivation, weather events, integrity of infrastructure, and processing of spent water. Water-quality concerns associated with commercial-scale production of algal biofuels and salinization of water sources **(Claire, 2014)**. Potential water-quality benefits are reduced runoff of herbicides and insecticides compared to corn-grain ethanol or soybean-based biodiesel because of their reduced use, and reduced eutrophication if there are no releases of culture water or if algae are used as a means to remove nutrients from municipal waste, confined animal feeding operations, and other liquid wastes. (**Albert and Raleigh, 2011**)

Biodegradation: - responsibly sited and managed landfills are often preferred over other waste disposal methods. They allow most waste to delay safely and naturally. Conversely the positive effects of biodegradation are often over stated when, in reality, landfills tend today mummify their contents, severely prolonging oxidation and natural break down process (**Albert, Raleigh, 2011**)

2.4.2. Economic effects

Sitting resistance and regulation; no one wants to live near a landfill and as regions urbanize, it becomes more difficult to find land that is suitable for dumping and amenable to the surrounding population couple this with increasing regulation and it becomes more difficult to efficiently and diplomatically site a landfill. This difficult often causes politicians to post pone spitting new land fill by encouraging alternative mean of solid waste disposal (**Henry *et al.*, 2006**).

2.4.3 Social Effect

Although landfill (dump) or sanitary transfer station provide an important municipal service, they have historical been associated with breach of environmental justice, because they have often been located in low income areas and in communities of color. More prevalent in new York city, Washington DC, Atlanta and San Francisco, among others, these issues of environmental justice were centered up on the fact that waste came from outside the communities where the facilities were located, that they resulted in negative impact such as national degraded health and environmental conditions and compromised community revitalization Plans and economic activity (**Schniel et al., 2012**).

2.5. Solid Waste Management

Solid Waste Management (SWM) practices include collection of generated wastes, waste separation or segregation, storage, transfer and transport, transformation, treatment and disposal. The rapid and constant growth of urban population has led to a dramatic increase in urban solid waste generation, with a crucial socio-economic and environmental impact (**Henry *et al*., 2006**).

Solid waste management (SWM) has been a big challenge to both the developed and Developing countries all over the world. Basically, municipalities are giving preferences only on the collection of the waste and dumping it, while the principle of 3R's (waste reduction, reuse and recycle), are not prioritized by the municipalities for a sustainable solid waste

Management. Increasing public awareness to the necessity of clean environment for good Health, at both local and national governments are facing public pressure to the proper management of the municipal waste (**Henry *et al*., 2006**).

2.6 Solid Waste Management Practices

Practices of solid waste management are techniques used to manage the waste or they are methods carried out to manage solid wastes, they are a number of effective techniques that can be used to manage. They include shrinking the waste stream, recycling, commercial scare recycling and composting and incineration (**Sha Ato *et al*., 2007**).

2.6.1 Recycling

Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, a procedure called kerbside collection. In some communities, the owner of the waste is required to separate the materials into different bins (e.g. for paper, plastics, metals) prior to its collection (**Sha Ato *et al*., 2007**). In other communities, all recyclable materials are placed in a single bin for collection, and the sorting is handled later at a central facility. The latter method is known as "single-stream recycling" (**City of Chicago, 2013**).

The most common consumer products recycled include aluminum such as beverage cans, copper such as wire, steel from food and aerosol cans, old steel furnishings or equipment, rubber, polyethylene and bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fiberboard boxes. (**Sha Ato *et al*., 2007**).

The type of material accepted for recycling varies by city and country. Each city and country has different recycling programs in place that can handle the various types of recyclable materials. However, certain variation in acceptance is reflected in the resale value of the material once it is reprocessed. In July 2017, the Chinese government announced an import ban of 24 categories of recyclables and solid waste, including plastic, textiles and mixed paper, placing tremendous impact on developed countries globally, which exported directly or indirectly to China (**Walker, 2018**).

2.6.2 Commercial Scale recycling and composting

Recycling house hold waste is the bed rock of recycling program. But large scale recycling is growing rapidly. The most common large scale recycling and composting are municipal yard waste and tree trimmings. It allows natural aerobic decomposition to reduce organic debris to a nutrient rich soil amendment excess packaging of food and consumer products is one of our domestic trash by volume. The preferred waste hierarchy is No packaging, minimum packaging, reusable and Recyclable packaging (***Shatir et al*., 2017**).

2.6.3. Composting

Recoverable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity and heat, and combined heat and power (CHP/cogeneration) maximizing efficiencies. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter (**Montomert country, 2013**).

2.6.4 Incineration

Incineration (burning) is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of both municipal solid waste and solid residue from waste water treatment. This process reduces the volumes of solid waste by 80 to 95 percent. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash. (**City of Chicago, 2013**)

Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Incineration is common in countries such as where land is scarcer, as the facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) is broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity (**USEPA, 2014**). Globally, waste-to-energy accounts for 16% of waste management. Combustion in an incinerator is not always perfect and there have

been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organic compounds such as dioxins, furans, and PAHs, which may be created and which may have serious environmental consequences. (**NEC, 2014**)

3 MATERIALS AND METHODS

3.1 Study Area Description

The study was conducted to assess the assessment of solid waste management in Bekure Sub-city, Wolkite Town, Gurage Zone, Southern Nation, Nationalities, and People's regional state. Wolkite town is located in south west of Ethiopia, 158 km from the Addis Ababa. It is located at 8°17' N latitude and 37°47' E longitude and an elevation between 1910 and 1635 meters above sea level. The climate condition of the study area is weynadega. The mean annual maximum and minimum temperature of the town is about 27°c and 7°c respectively. Based on the 2007 census conducted by the center of statistical agency, wolkite town has a total population of 43,536, of whom 22,628 are male and 20,908 are female (**CSA, 2007**). The majority of the inhabitants (48.17%) practiced Ethiopian Orthodox Christianity, while 42.31% are Muslim, 7.86% are Protestants, and 1.34%, are Catholic. The population is multi ethnic; six major ethnic group reported in Gurage zone are: Gurage people(82%), Mareko (4.28%), the Amhara(3.36%), the Kebana(3.34%), the Silte people(2.71%) and Oromo people are(1.69%); all ethnic group made up of 2.62% of population (**Hairu, 2013***)*

3.2 Study Design and Study Period

Across-sectional study design was used to assess the factors that contribute for the source of the municipal solid wastes, its effect, and management practiced in Bekur Sub-city, Wolkite Town. This study was conducted from March 2019 to June 2019

3.3 Sources of population.

The total population of study area was 13, 638, male (5694) and female (7944) and there were 2,783 house hold (**CSA 2007**) of the kebele.

3.4 Sample Size and Sampling Techniques

Simple random sampling method was used to select sample respondents from the sub city. Simple random sampling is method used for selecting n unit out of the N such that each has equal chance of being drawn. Some of the respondents were the owners of hotels and restaurants, while some of them were shopkeepers and house holders. The number of respondents participated in the study were decided based on the sample formula developed by Cochran as follows. In short, the sample was taken from the total population by scientific statistical method formula of the following, (**Cochran, 1989**)

$n_0 = \frac{Z^2 pq}{e^2}$ And $n = \frac{n_0}{1+\frac{n_0}{N}}$

Where:

n= is the number of the sample size,

n_0 = is require sample size.

N= total house hold from which respondent will be selected in Bekur sub city=2,783

z-is the standard error at 95% confidence interval.

P= probability of success, take 50% if there is no previous data.

q= probability of failure (p and q are taken as 50% if there is no previous data)

Z=1.96

q = 100% − p, =50%

Marginal error (e)

For Bekur sub city $\mathbf{n_0} = \frac{1.96^2 * 0.5 * 0.5}{0.1^2}$ = 96

According this formula, n= n_o if n_o/N <0.05 and

n = $\frac{n0}{1+\frac{no}{N}}$ if n_o/N>0.05

n_o/N =96/2,783= 0.034

n_o/N = 0.034 less than 0.05 therefore, n = n_o, 96

3.5. Data collection method

Information regarding Solid waste, source, effects and management was collected between March and May mainly via house holder tours, semi-structured interview, and field observation

3.5.1. Field observation

Field observation was conducted in the study area, Wolkite town Bekure sub city, by walking with informants where the solid wastes mostly available. The purpose of observation was to check the availability, types (most common), and management practice of solid waste.

3.5.2. Questionnaires (semi- structured interview)

Questionnaire was conducted face to face with selected informants who have deep knowledge regarding to sources, its effect and managements method of solid waste. Interview was prepared in English language and then translated to local language (Guragigna) and Amaharic

3.6. Data Analysis

The obtained data was analyzed by using Microsoft office version such as excel. Examined data was presented using the graphs, figure and tables.

4. RESULTS AND DISCUSSION

4.1. Socio-economic characteristics of households

Ninety six respondents were selected for this study. During the survey we include the following demographic characteristics such as sex, age, occupation, educational level, and marital status as the following table 4.1

Table 4.1 demographic characteristics of sample respondent householder

Demographic characteristics		**Frequency**	**Percentage (%)**
Sex	Male	58	60.40%
	Female	38	39.60%
	Total	**96**	**100%**
Occupation	Merchant	50	52.08%
	Governmental employees	8	8.33%
	Farmer and other labors	38	39.60%
	Total	**96**	**100%**
Age	20-30	46	48.00%
	31-40	29	30.00%
	41-50	17	18.16%
	>50	4	3.84%
	Total	**96**	**100%**
Educational status	Illiterate	35	36.46%
	Elementary completed	41	42.70%
	High school completed	12	12.50%
	Above high school	8	8.34%
	Total	**96**	**100%**
Marital status	Unmarried	21	21.88%
	Married	74	78.12%
	Total	**96**	**100%**

Source survey, 2019

4.2. Solid waste compositions

Even though different countries use different Mechanisms to characterized solid wastes we used physical composition to classify solid wastes (Table 4.2). Different factors can influence the percentage of solid wastes. Among these factors wealth is common one. Not only wealth, but also consumer patterns significantly influences waste composition. According to survey analysis the following percentage composition solid wastes was found from the study area.

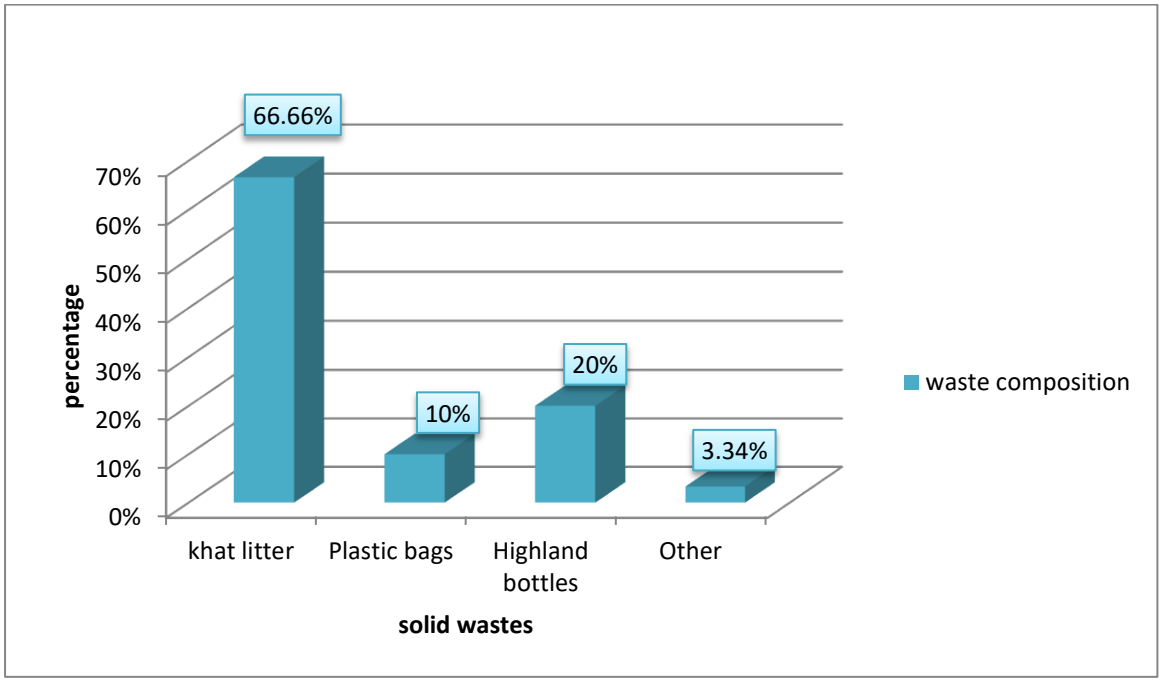

Figure 4.1 Solid waste compositions

Our result is in accordance with the findings of Dufera (2017) who did on the assessment of solid waste management in Awady city. He revealed that the most constitutes of solid wastes in the Awady town was khat left over (75%) and other wastes accounts (25%) solid of solid waste. According to Dufera (2017) there are some factors that contribute for the abundance khat litter in the solid waste in the study area. Those are Awady town is the center of khat trader, considering chewing khat as modernization, religion factor, and society culture (**Dufera, 2017**)

The above mentioned factors are also common factors wolkite town. Additionally another study done by Kebebush (2018) on assessment of solid waste management of Ambo city is not agrees with our findings. She revealed that the major composition of the solid waste was house hold wastes rather than Khat litters (**Kebebush, 2018**)

4.3. Solid waste generation rate

Actually solid waste generation was related with the development of individual's income i.e. As income increase solid waste generation also increase. For example using artificial water, industry food, buying more khat and the like are become common as income increase. Since the area is the center for khat marketing, the khat left over (litter material) was highly observed everywhere in the town. This means that households with higher incomes generated larger quantities of solid waste per day in that particular area it may vary from place to place. As the recommendation that it is best if community become awarded regard to these problems.

4.4 Effects of solid waste

4.4.1. Environmental impacts

Waste collection methods vary widely among different countries and regions. Domestic waste collection services are often provided by local government authorities, or by private companies for industrial and commercial waste. Some areas, especially those in less developed countries, do not have formal waste-collection systems. If solid wastes are not correctly disposed at appropriate area, it has several impacts. Among the impacts of solid wastes human health, environmental pollution, and economic problem are common. From our observations some areas of study area give bad odor in case of long lasting accumulated solid waste. Directly these odor become source of some disease and other environmental impact

Our observation of the study area and information from local community, it showed that the disposal of waste in open spaces and nearby house was decreased from previous one (**interview answer from community**) but the problem was not totally solved. The decomposition of waste into its constituent chemicals was also a common source of local environmental pollution. Since the collected wastes were disposed in the open space wastes were scattered here and there at each corner of the town which is affect the image of the town. The major environmental concern was gas released by decomposing garbage. Methane is a byproduct of anaerobic respiration of bacteria, and these bacteria thrive on landfills with high amount of moisture and generates very seriously bad odor than can effect on society health. In this disposal area plastic containers, khat and metals are occupying the majority of the disposal which is unable to decompose to be converted to soil. Therefore it requires attention to eliminate from the environment to reduce the environmental pollution (**USAPA, 2008**).

4.4.2. Human health Risks

Solid wastes have several components which can affect human health. There are some health risks associated with solid waste handling and disposal in the study area. The main problems can be classified into the following categories:

Presence of human fecal matter: Actually human fecal maters contain different types of microorganism which pathogenic to human health. We were asked some peoples regarding to this problem, and respond were as they are in problem of health by solid waste disposed to ever.

The decomposition of solid: Solid waste like khat litter constitutes chemicals which contaminates air and water systems when dissolved. As we have seen, solid waste specially left over khat is simple disposed on side the rode. So decomposition of those materials leads series of health problem.

The air pollution caused by consistently burning solid waste: Commonly collected wastes are burned (paper, some small metals,) and atmospheric air was polluted, latter cause health problems especially on respiratory tracts. Our result is in agree with the finding of other research who did the same issue in Mettu town (**Selamawit, 2016**)

4.5. Solid waste management in the study area

Like other big cities of Ethiopia, Wolkite town solid waste problem is getting a little attention. This problem gets common due to the economic inability of the households in the area to afford collection services, inappropriate placement and insufficient number of communal containers **(from interview with environmental protection office of wolkite town)**. The problem of solid waste littering around rivers and roadside is still one of the major environmental problems of the area. According to our survey data, 60 % of the respondent was collecting solid waste into fertilizer suck container and disposed into the field outside of the town and the rest 40% of the households disposed their waste either onto a communal container and/or open spaces like road side and near their home side. This is resulting due to the absence of awareness regarding the solid waste disposal management. The office of 'Environmental Protection and Sanitation' of wolkite town had tried to give awareness for the community about: the risks of disposing solid wastes at improper area, the proper way of disposing house hold wastes, and its advantages if the solid wastes are recycled through proper disposal; once a week. This activity of giving awareness to society had been given where local community meet, or at school for students

4.5.1. Municipal service

From our survey, we noticed that in addition to the insufficient number of the communal container, the placement of the communal containers was inappropriate and user number size was not given due consideration. As we seen from field observation and survey analysis, there was long distance between householders and solid disposing area (communal container). These were the main factors for householders and some of the primary wastes collector groups to dispose wastes in the nearby open spaces, road side, and plantation areas. In Hawassa, there was sufficient number of communal containers and they were kept at appropriate place to easily dispose solid. In addition, there were private services that transport solid wastes from collected area to appropriate disposing area (**Solomon, 2017**)

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Generally solid waste refers to the range of garbage arising from animal and human activities that are discarded as unwanted and useless, while solid waste management is process of proper disposal of those solid wastes. A study was done at wolkite town, specifically Bekure sub city. As it was observed from the study result wolkite town is a very densely populated and the center for khat marketing that has made the town, poor in solid waste management. The litter of khat, plastic bags and metal bottles were seen everywhere in the town. The khat users (traders) were disposing the leftover at road side including the plastic packaging materials and plastic bottles. Due to minimum or no as such facilities were provided by the Municipalities for waste disposal the households were disposing the wastes on the field.

5.2. Recommendation

Generally, the following possible recommendations can be drawn from this survey study;

- Attention should be given to solid waste management system of the wolkite town by the municipality.
- To reduce the problem resulted by solid wastes, wolkite town environmental protection authority have to create awareness, and teach the society about solid waste effect, and method of managing, or reducing solid wastes
- Wastes disposal area should be prepared by the government or respective body to overcome the problem.
- Awareness creation to the community is an essential measure to reduce the problem of solid west management of the town.

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APPENDIX

Questionnaires

Dear respondents, I would like to know about the Solid waste management in the town. Your response will help policy makers to formulate an informed policy about improved waste management service. The interview will take a few minutes and the answers will be completely confidential and strictly for academic purpose. Thus, please answer the questions honestly and as truthfully as you can. Please thick (√) on the box which you expected to be correct answer.

A. <u>Household Details</u>

Respondent Sex_____, Keble _____ education level_____, job_____, marital status _____

B. <u>General information</u>

1. Do you think that solid waste disposal method is a problem in your neighborhood?

Yes ☐ No ☐

2. If your answer for question number 1 is yes, what are they? Please thick **(√)**

a. Littering and looks bad ☐ b. Effect on human health ☐

c. Effect on environment ☐ d. Others…….

3. Do you store your household rubbish in? For each storage, write down the number of each used per a week. Number per Days

A. Plastic bags ☐ _____

B. Cardboard boxes ☐ _____

C. Rubbish bin/ drum. ☐ _____

D. No storage direct disposal to dump ☐

_____

E. Others …….. ….

_____

4. Where do you dispose your generated waste?

A. Nearby container B. Open spaces C. Near home C. Others specify ……..

5. Can you roughly classify the composition of your generated waste?

A. Chat litter ……. % B. Plastic …… % C. Paper ……..% D. Others ……%

6. Do you separate different type of waste at your home?

Yes ☐ No ☐

7. Would you do so if you are told by your collection service provider?

Yes ☐ No ☐

11. If not for question number 10 no, what type of media do you use? _____

12. Do you think that media has raised your awareness about solid waste management?

13. Please explain why the solid waste management is important to you._____

_____