

Management of Solid Waste Disposal in Mahaangmye Township

Cherry Win*, Than Than Myint **, Hla Kyi***, Thein Htoo****, Yin Lae Swe Maung*****,
Naw Lay Nwe Phaw*****

Abstract

In order to meet man's daily needs, man utilizes some materials and discards the non-usable portions. The discarded materials have been termed as 'solid waste' or 'refuse'. Thus the solid waste includes all kinds of solid and semi-solid waste products. Lack of space for dumping solid waste has become a problem concerning the increasing costs of waste disposal, possible hazards to groundwater, and maintaining air quality. Problems with solid waste have increased dramatically because of population increases. Mandalay city had population of 1,360,138 and Mahaangmye Township had population 196,431 constituting 14.33% of total population of Mandalay City in 2019. Solid waste problems with Mahaangmye Township are directly concerned with increase population. Therefore, the problems associated with solid waste disposal in this study area become great challenges for urban residents and it is an effort to combat this problem intellectually.

Key words: refuse, discarded, hazards

Introduction

In Mahaangmye Township, there are various types of solid waste and a great bulk of solid waste generated daily. Rapid urban development pacing developing countries has come with serious environmental challenges concerning solid waste disposal management.

Aim and Objectives

The main aim of this paper is to create a model unit of Waste Free Zone in Mandalay City.

The objectives of this paper are:

1. To find out the types of waste that output in this township.
2. To survey how much produced waste and how to keep it.
3. To investigate public awareness on waste problems.
4. To suggest waste disposal system and practices in this township.

* Lecturer, Dr, Department of Geography, Yadanabon University

** Associate Professor, Dr, Department of Geography, Yadanabon University

*** Associate Professor, Dr, Department of Geography, Yadanabon University

**** Associate Professor, Dr, Department of Geography, Yadanabon University

***** Lecturer, Dr, Department of Geography, Yadanabon University

***** Lecturer, Department of Geography, Yadanabon University

Data and Methodology

The data are used in the primary and secondary. In the primary data, field the survey and questionnaires are used as the research technique. In the secondary data, the official data are collected from the related government offices and documents. In analyzing, the data which are primary and secondary, approximately techniques or methods are used to find reasonable, reliable and validity, especially statistical methods in geography such as method of correlation.

Physical Bases of Mahaangmye Township

Mahaangmye Township is situated between 21°57'N and 21°58'17" N latitude and 96° 03' 27" E and 96° 07' 53" E Longitude. It is bounded on the north by Chanayethazan township, on the south by Chanmyathazi Township, on the east by Patheingyi Township and on the west by Ayeyarwady river. It has an area of 5.64 square miles. It is composed of 18 wards in the township. It has a rectangular shape.

Most of the Mahaangmye Township is flat land but it is slightly lower to the south and southeast. Ayeyarwady River is from north to south as the western boundary of the Mahaangmye Township. In this township, Mahanadi creek, Yaeni canal, Shwetachaung, Ngwetachaung and Thingazar creeks drain are in this township. Due to the lack of drainage, some areas such as Thanlyetmaw (E) and Thanlyetmaw (W) have been flooded at the times of heavy rainfall. Thus, this area has pollution in some extent at that area by covering waste materials.

It is generally experiences a hot and dry climate annually. It has an average maximum temperature of 99.95°F in summer and an average minimum temperature of 71.75°F in winter. The range of temperature is 28.2°F. The area receives Topical Sawanna Climate (A.w). It receives an average annual rainfall of 36.29 inches.

Social Bases of Mahaangmye Township

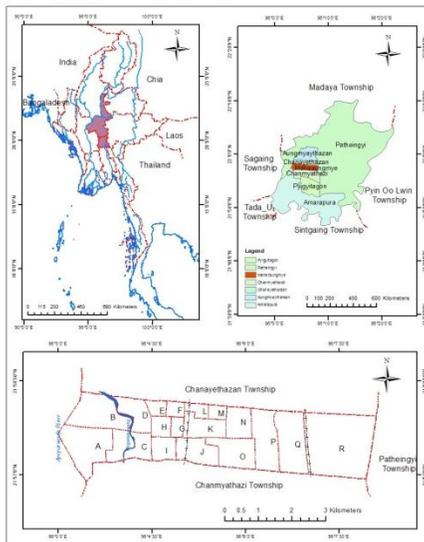
According to census reports, the total population of Mahaangmye Township was 241,113 persons in 2014 and 196,431 persons in 2019. During the six years period from 2014 and 2019 the total population decreased by 52,165 persons with a population growth rate of -21.63 percent. People are concentrated along the main road. The distribution of population is uneven. It varies with each ward. The highest populated ward is Thanlyetmaw (E) with the total population of 27,802 persons and the lowest population distribution is the University ward has only 3,146 persons and it is 1.6 percent of the township population. The population density of the wards varies with places. Shwebonshein Ward has the highest density with 325,300 persons in 2019.

Table (1) Total Population and Growth Rate of Mahaangmye Township (2014–2019)

Year	Total Population	Population Growth	Growth Rate %
2014	241,113		
2015	188,948	52,165	-21.63
2016	189,866	918	0.48
2017	191,954	2,088	1.09
2018	193,277	1,323	0.69
2019	196,431	3,145	0.87

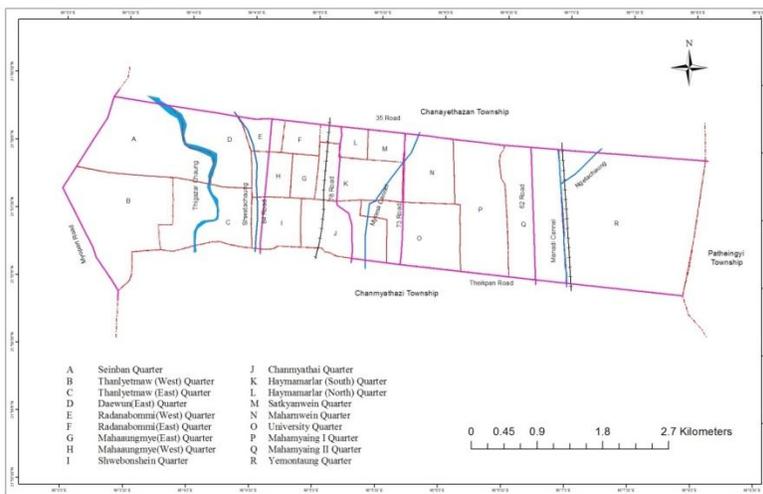
Source: Immigration and National Registration Department, Mahaangmye Township

Figure (1) Location of Mahaangmye Township



Source: Department of Geography, Mandalay University

Figure (2) Wards of Mahaangmye Township



Source: Department of Geography, Mandalay University

Definition of Waste

Waste can be defined as any forms of solid, liquid or gaseous emission as a result of human activities, for which no use can be done by the organism or the system. In other word, they are quite after pollutants of the environment and sometimes unsuitable material to use or unuse.

Type of Waste

As we approach to the modern and developed nation, there must be to take care of the waste problem that facing our society. Waste can be seen in many forms in our immediate environment. these waste can be divided into four types. They are: (a) Industrial Waste (b) Household Waste (c) Commercial Waste and (d) Miscellaneous Waste.

Conditions of Waste Out-put of Mahaaungmye Township

All forms of waste such as solid, liquid and gas can be found in Mahaaungmye Township. Solid waste disposal has mainly been undertaken by Mandalay City Development Committee. Drainage systems have been maintained to carry out sewages disposal system. It is very important because sewage are the reproducing ground of mosquitoes which threaten the public health. Gases emitted from vehicles and industries cannot be fully undertaken by modern society. Therefore the condition of these gases has reached a certain amount that causes our environmental pollution problem.

Waste Keeping System

Population growth, income, use and consumption pattern changes continue to expand the volume of waste material. Moreover, changing consumption pattern and packing system do affect upon the public health and can damage our environment. Therefore, we need to take care of waste keeping system. In Mahaaungmye, waste keeping systems in both types are mostly as follow:

(1) keeping by basket and plastic bag, (2) owned waste tank construction, (3) putting into the dustbin, (4) putting into the waste tank that constructed by M.C.D.C., (5) land filling, (6) burning (or) incineration, (7) pour-out of solid waste into the creeks and municipal drainage system, (8) selling waste such as hair; pieces of rubber (tire), pieces of cloth, pieces of jade, etc., (9) cleaning and keeping by municipl workers and (10) indiscriminate waste

Most of the people used baskets and plastic bags in keeping waste, while owned waste tanks construction are rare.



Waste Keeping System in Ayeyarwady Tea Shop

Collection of Waste

In general there are four types of waste collection in Mahaaungmye. They are (1) Alarmed Bell system, (2) Trolley, (3) Individual collection for recycling and (4) Non-collected waste.

Most of the wastes are daily collected by ring-system. They carry out mainly along main roads, markets, bazaars and some streets. M.C.D.C waste collecting vehicles are not enough to keep the total production of waste.

Push-cart collection system can be mainly found in the western-half of Mahaaungmye Township, especially along the streets which cannot reach waste collecting vehicles cannot research.

Collection for recycling is made by individuals. It is one of the environmental treatment systems. This type takes places all over the township.

In an exceptional case, there have been no collected waste on narrow streets, land-fill areas, sparsely populated areas where indiscriminate wastes are put on it. It is the most dangerous for it can course health and environmental problems.

Output of Waste

The production of waste is not unique because of the different activities, while the rate of population is different due to the consumption pattern and regular income of each and every household. The average production rate of waste by a household has an amount of 1 to 2 baskets per week. On the other hand, it has a maximum amount of 6 and above baskets per day in some restaurants. The total production rate of waste in study area was 162 tons per day in 2019. The annual amount of waste in this township reached up to weight of 59,123 tons in 2019. Aungmyethazan township is the highest amounting of 96,174 tons. On the other hand, the lowest is Amarapura Township with 38,673 tons in 2019. Mahaaungmye Township had 21.33% of waste production in M.C.D.C area.

According to table (2) the annual report of M.C.D.C, the output of waste in Mahaaungmye Township generally increase. During period between 2014–2019, the output of waste in this

township reached the minimum amount of 48,648 tons in 2014 with the weight of 302,663 tons at the sometime in Mandalay city.

According to the data in table (4), there is a very high degree of positive correlation ($r=0.94$) between labour and the amount of waste that collected per day. In this case, collected waste per day is not the total amount of waste per day. It has an exceptional case. However, there are very high degree of positive correlation ($r=0.92$) between population and the total amount of waste that collected per year. We must consider about consumption pattern income rate, packaging system and people's attitude—those affecting on waste problem.

In the study area, the households which have different numbers of family members, distance from communal dump site and from the regular routes of garbage collection. Table (4) shows the average amount of solid waste from household of 18 wards, by this measurement, the rate of solid waste generation can be estimated at 162 tons per day.

According to Table 2, the largest volume of solid waste generation is found in Thanlyetmaw (E) Ward with 14.88 tons per day this is due to large number of households and the ward is lied in the southwestern part of Mahaangmye Township and the least is found in University Ward with 4.21 tons.

Table (2) Waste output day and year (tonnages) In Mahaangmye Township

Year	Labor	Number of Waste Carrying car	Waste carrying trip/day	Waste output/day (tonnages)	Waste output/year (tonnages)	Population
2014	212	37	2	892	48,648	241,113
2015	250	41	2	896	58,233	188,948
2016	250	46	2	866	59,326	189,866
2017	235	48	2	890	53,882	191,954
2018	224	49	2	1,059	56,861	193,277
2019	211	49	2	1,148	59,123	196,431

Source : M.C.D.C (2019–report) and Field survey

Table (3) Labor, Number of Waste carrying car, Waste Carrying trips, waste tonnages / day / year In Mandalay City 2019

Township	Labor	Number of Waste carrying car	Waste carrying trip/day	Waste output/day (tonnages)	Waste output/year (tonnages)	Population
Aungmyethazan	270	46	102	264	96,174	189,292
Chanayethazan	273	49	108	202	73,814	148,792
Mahaaungmye	211	49	108	162	59,123	196,431
Chanmyatharzi	156	50	100	235	85,711	225,695
Pyigyitagon	193	48	96	180	65,667	159,086
Amarapura	90	28	56	105	38,673	200,765
Total	1,193	270	570	1,148	419,165	1,120,066

Source: M.C.D.C (2019-report)

Table (4) Population Density, Households and Desposal Waste In Mahaangmye Township (2019)

No	Ward	Households	Total Population	Area (sq-mile)	Density	disposal Waste Per day
1.	Seinban	3615	17104	0.34	50503	13.04
2.	Thanlyetmaw (W)	5800	26052	0.35	74434	14.48
3.	Thanlyetmaw (E)	5860	27802	0.45	61782	14.88
4.	Daewun (E)	2810	13554	0.34	39865	11.12
5.	Yadanabommi (W)	1129	5223	0.12	43525	5.02
6.	Yadanabommi (E)	1159	5563	0.40	13908	6.34
7.	Mahaangmye (E)	1150	5647	0.21	26890	5.93
8.	Mahaangmye (W)	1123	6330	0.34	18617	8.02
9.	Shwebonshein	1350	6506	0.02	325300	9.98
10.	Chanmyathazi	1791	9446	0.20	47230	10.13
11.	Haymamarlar (S)	915	4844	0.09	53822	4.81
12.	Haymamarlar (N)	1307	5824	0.30	19413	5.67
13.	Satkyanwezin	1988	10507	0.12	87558	10.31
14.	Mahanwezin	2383	10872	0.26	41815	10.56
15.	University	692	3149	0.34	9261	4.21
16.	Mahamyaing I	2613	14453	0.59	26764	10.10
17.	Mahamyaing II	2138	11420	0.49	23306	9.11
18.	Yemontaung	2504	12135	0.82	14799	8.29
Total		40327	196431	5.73		162.00

Source: Immigration and National Registration Department, Mahaangmye Township



**Waste constructed by M.C.D.C Collection of Waste by Trolley
Transportation of Waste**

Mandalay City Development Committee is employing the method of direct transportation. In this method, as the collection vehicle gets filled to its capacity, it proceeds direct to the site of disposal. Most of the collection vehicles usually carry on along the main roads.

About 49 trucks of 1.5 to 1.8 ton capacity are engaged in the dual process of collection and transportation in this township. Since each vehicle first collects the solid waste and then disposes at the site of disposal, a lot of time is wasted in the collection process.

In addition, the collection and transportation vehicles are opened and they give rise to a lot of odour problems and spillage of solid waste. These collection and transportation systems have to be mechanized and improvised to some extent in our city at least. The requirements on collection and transportation vehicles and their equipments are manifold. For hygienic reasons the workers must come into contact with the solid waste as little as possible.

Methods of Solid Waste Disposal

There are four types of disposal for solid waste: They are,
Incineration

One of the most effective means of dealing with many wastes, to reduce their harmful potential and often to convert them to an energy form, is incineration. Incineration is a waste disposal process by means of which solid, liquid and gases combustible wastes are converted through controlled combustion to a residue which contains virtually no combustible matter and gases which related to the atmosphere.

Incinerator's also produce air pollution including highly toxic dioxide requiring controlled equipment. Acid gases and heavy metal are also released by waste burning. The gases cause atmospheric pollution and acid rain, low, metal contributes to toxicity of the ash, that is the inevitable products of incineration which require land-fill disposal.

In Mandalay city, modern incinerations are rare due to expensive cost and air pollution problems. But some local residents in Mahaaungmye Township use incineration for their own solid waste. This incineration affected the area where it was operated.

Land Filling

In Mahaaungmye Township, some wards such as Thanlyetmaw (E) and (W) use land filling method, because these wards are situated in low lying area and flooded in the rainy season from Thingaza canal. For land filling, some residents allow to dispose the solid waste in their own residence while others by the truck of solid waste. And then they fill the earth over the filled solid waste. In this area, land filling creates attack of the esthetic environment and odours problems.

Open Dumping

The oldest and most widely used method for ultimately disposing of solid waste is land disposal. Until the middle of the 20th century, waste was simply placed in a heaped on top of the ground and the disposal site was called a dump. These uncontrolled, open dumps quickly become breeding grounds for many vectors of disease, including rats, mosquitoes, and fly. In addition to posing a direct threat to public health, open dumps were smelly, unsightly nuisances. They also

polluted surface water and ground water. Nevertheless, most municipal waste is still disposed of on land.

In Mahaangmye Township, indiscriminate disposals are seen in area in the neighbourhood of Ayeyarwady and Yemontaung ward. Some wards still use the open dumping to Ayeyarwady River and Shwetachaung canal.

Recycling

Even with the growth of recycling programs, however, recycles only a small percentage of the municipal solid waste generated. There are two factors,

- (i) Benefits of recycling
- (ii) Recycling concerns

Some benefits of recycling readily recognizable, such as conservation of resources and pollution reduction. In Mahaangmye Township, some wards such as Dawnachan have the collectors for recycling waste. Some scavengers and individual pickers collect, sort and sell the waste to main body collectors in Palinwin ward of Aungmyethazan Township. And these wastes are recycled in industrial zone (1).

Problems associated with recycling tend to be either technical or economic. While the plastics used in packing are recyclable, the technology used to do that differs from plastic to plastic. The recycled plastic products are not widely used and the demand for recycled products must grow in recycling to succeed on a large scale for Mandalay city.

Management of Solid Waste Disposal

Waste managements are 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.

M.C.D.C laid down by law for citizen to obey for cleaning city.

- (a) In M.C.D.C area, anyone must put the waste or repugnant materials in sense into dust bins limited by M.C.D.C
- (b) Don't put the waste and repugnant materials on to the roads owned by M.C.D.C, main roads and foot paths and narrow streets.
- (c) Residents along the main roads must put wastes and repugnant materials into either basket or zinc bins or iron bins in front of the house during 6:00 am and 10:00 a.m. Those baskets or bins must not disturb the public running on the road. The wastes bins are put during the limit time.
- (d) Solid wastes and other repugnant materials from business must be put into area limited by M.C.D.C.
- (e) Solid waste from bamboo roof of houses and other repugnant materials must be put into M.C.D.C's limited areas by owners.
- (f) If those of wastes are collected by M.C.D.C's order,

Finding and Suggestions

The total output rate of waste in the township was 162 tons per day in 2019. Alarmed bell system at waste collection is experienced that (alarmed bell system by car carried out mainly along main roads) it is not enough to keep the total output of waste because alarmed bell system by car carried out mainly along main roads only. Waste collected cars may not reach along the streets especially narrow streets (eg. Thitsar, Aungmingalar) and sparsely populated areas. Therefore, some residence of waste may be found in these areas. Trolley collection system may be found especially in the western half of Mahaaungmye Township. In the lowland areas such as Thanlyetmaw, due to the uses of landfill method; this areas may be experienced the most dangerous health and environmental problems.

It is necessary for people to set up the posters and singboards concerning with systematic waste disposal. As MCDC, the effective management and control measures as well as the awareness of waste disposal should be implemented for the areas concerned in order to maintain the waste free zones. Moreover, in modern age, using plastic packages for commercial have been increased. So that it is necessary to reduce plastic packages for commercial and using recycle package should be promoted. In the study area, push-card or trolley collecting system support a fairly condition for the waste disposal. Therefore, this system should be promoted by private sector.

Future Prospect

Currently, open dumping is the major waste disposal method in Myanmar, with approximately 60% of the total waste disposal methods of the country. Increasing output of waste coupled with population pressure has resulted in the indiscriminate waste of some people of Mahaaungmye Township, transforming it into the environmental pollution problem and affecting upon the public health in the area. The situation has been prevented by the following activities.

- (1) MCDC had to supply sufficiently waste collecting cars and collect daily the output of waste from the source area.
- (2) People need to learn 'how to make less waste and how to reuse or recycle',
- (3) People have been 'responsibility' for the systematic waste disposal in the township.

Acknowledgements

We are deeply indebted to Dr. Khin Win, Professor and Head, Department of Geography, Yadanabon University, Dr. Nay Aung, Professor Department of geography and Dr, Hla Kyi, Associated Professor, Department of Geography, Yadanabon University, for their permission to choose this field to do research work. Moreover, we are also grateful of Departmental personal for their help in collection of the data and also many thanks go to words in the study area for their helping.

References

- Annual reports : Mandalay City Development Committee (2014 to 2019).
- Jar Phan, Ma (2016) : A Geographical Analysis of Waste Disposal in Lashio town, M.Res (Thesis), University of Mandalay.
- Khun Kyaw Aung Hein, Dr (2017) : A Geographical Analysis on Waste Disposal Management in Nyaungshwe Township, Ph.D dissertation, University of Mandalay.
- Zar Ni Phyo, Mg (2019) : A Geographical Study On Solid Waste Disposal Management In Chanmyathazi Township, M.A (Thesis), Yadanabon University.

