

PRESENT SCENARIO OF MUNICIPAL SOLID WASTE MANAGEMENT IN SATKHIRA MUNICIPALITY

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ABSTRACT

The increasing quantity of solid waste is a burning issue and is faced by all developing countries specially in urban areas due to increasing population rate, rapid economic growth, rise in community living standard and unawareness of common people. This study aimed at investigating present scenario of solid waste management in Satkhira municipality located in the south west corner of Bangladesh. This paper has been planned to collect primary and secondary data, field observation, questionnaire survey, total operating cost and give some proposal for the improvement of proper solid waste management through various schemes to ensure sustainable development. Questionnaire Survey 2017 reveals that in Satkhira Municipality (SM) many people have no proper idea on Municipal Solid Waste Management (MSWM). In spite of containing 110 dustbins, a large number of people drop their waste beside the road, due to distance and miserable dirty condition. The municipality collects the solid waste from dustbins and secondary disposal sites. It has 3 trucks, 8 rick-vans and 2 alom-sadhu and a total number of 92 waste collectors. The current coverage of this facility is about 50% of the municipal area and the collected waste is about 10 tons/day which is only 25% of the total production. Moreover, clinical and industrial wastes are not managed by SM. The Municipality has installed a dumping station (9.84 acres) in Binerpota. Recently, a Bio gas plant (80m³) has been installed in Rosulpur to generate energy from waste. Some public-private partnership initiatives have been taken to facilitate resource recovery and sustainable environmental development.

Keywords: Solid waste generation, solid waste management, questionnaire survey, uncontrolled dumping, sustainable development

1. INTRODUCTION

Waste refers to materials, produced from all levels of human and animal work which are designated as useless or unwanted. According to Global Waste Management Market Assessment (2007) around 2.02 billion tons of waste are producing annually around the world with an annual increasing rate of 8%. Safe and sustainable waste management is now one of the imminent challenges in the urban dominated modern world. Increasing population, and development of community living standards, rapid urbanization and industrialization are working as a catalyst in solid waste generation rate in developing countries particularly in urban areas. Bangladesh is currently experiencing a period of rapid growth and urbanization concurrently with which proper management of generated solid waste is becoming a major issue otherwise it will cause health effect, aesthetic problem, drainage congestion, and odor, even might contribute to climate change issue (Rashid et al, 2011). The problem of waste is not only the due to the increase in number but also the lack of management system (Tinmaz & Demir, 2006). The municipalities are failing to provide proper waste management service to its dwellers due to severe financial constraints, lack of motivation and the absence of

effective legislation to protect the environment and to handle the waste, the whole system is becoming a threat for city dwellers, planners and other concerned stakeholders (Alamgir & McDoland, 2005). Like all the other municipalities in Bangladesh Satkhira municipality is also facing a huge challenge finding a way to manage its solid waste in a proper manner. It has a daily waste generation rate of 48.2 tons in which only around 12 to 15 tons are collected and managed by the municipality. Which shows that a huge amount of wastes remains unmanaged which is very alarming for its inhabitants. To ensure a clean, hygienic, and beautiful Satkhira the municipality is in search for a proper waste management system. All the tires of MSW management at Bangladesh are in the primitive stage and needs modernization through innovative and appropriate approach in association of local conditions for its proper management (Alamgir & Ahsan, 2007). To make a plan for the sustainable development of the SWM system the analysis of the present waste management system is necessary. This study aims to provide a clear and quantitative concept of the present scenario of solid waste management system in Satkhira municipality through physical investigation as well as social survey to seek out the motivations, problems and opinions of its dwellers. The final objective is to create a platform for planning of a Sustainable Waste Management System for Satkhira Municipality.

2. STUDY AREA

The study was conducted in Satkhira municipality located between latitude of 22°43'41"N and longitude of 89°05'54"E. The study area was comprised of 9 wards covering an area of 31.10 sq. Km. Figure 1 shows the location & map of satkhira municipality. Satkhira, the land of Sundarbans, gained a huge reputation as a business town for Bhomra port, the largest land port of Bangladesh. It is also famous for the production and export of Shrimp and mango. Satkhira municipality was introduced first as a "C" grade municipality in 1869 with an area of 31.1 sq. Km. It was reconstituted as Satkhira Town Committee in accordance with the provisions of Basic Democracies Order, 1959. Satkhira Town Committee was replaced by Satkhira Shahar Committee according to the Bangladesh Local Councils and Municipal Committees (amendment) in 1972. And then in 1977, it was replaced by Satkhira Pourashava in accordance with the Pourashava Ordinance and was declared an "A" class municipality with 7 mouzas namely Katia, Satkhira, Polaspole, Ramdebpur, Dohakhula and Rasulpur under its administrative jurisdiction with 9 wards. Satkhira municipality has a total population of 153,969 nos. Satkhira municipality is very sincere in providing good municipal facilities to its dwellers. In this regard, proper management of generated solid waste has become a huge challenge for the municipality as it is a prerequisite to maintain a healthy and safe environment. So, they are trying to improve the present solid waste management system by undertaking various policies. Yet a huge amount of solid waste is remaining unmanaged. To improve this situation the existing solid waste management system should be analysed and its weaknesses should be pointed out. In that context, this study will help a lot.

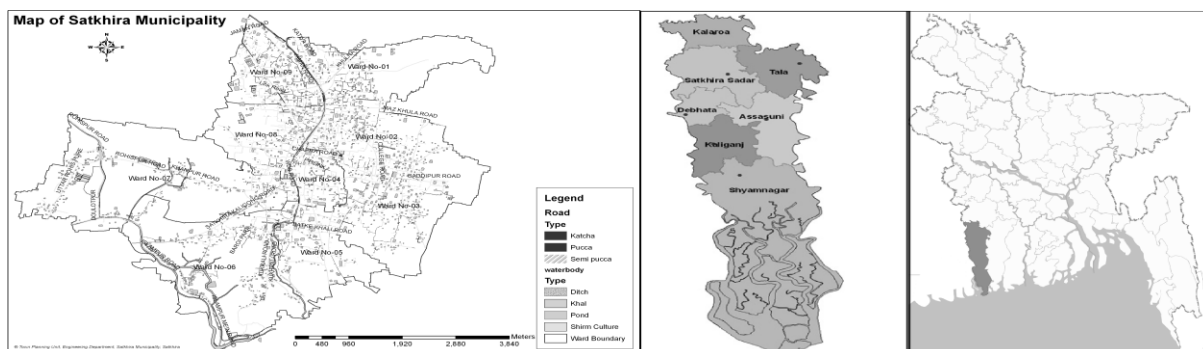


Figure 1: Location & Map of Satkhira Municipality

3. METHODOLOGY

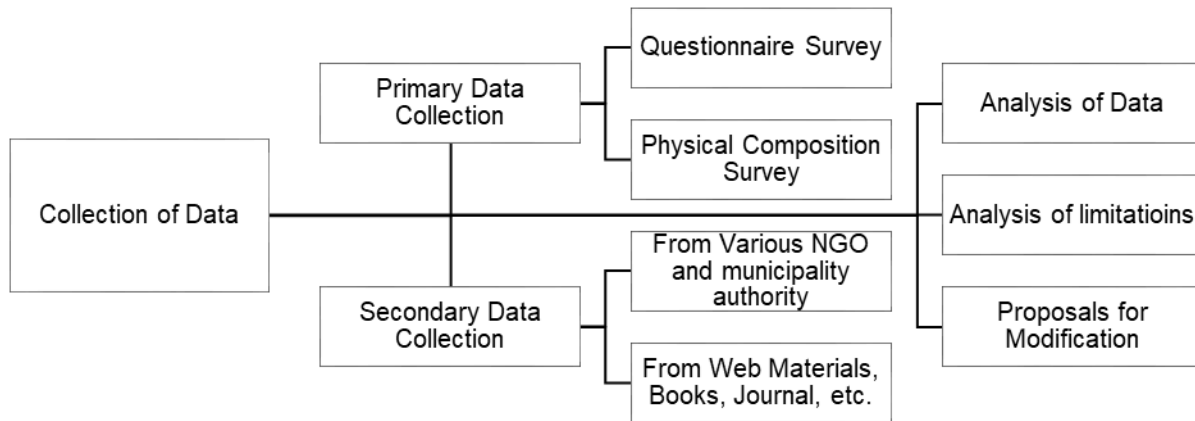


Figure 2: Flow Diagram

3.1 Collection of Data

3.1.1 Collection of Primary Data

The primary data was collected by means of two types of field survey. One is physical composition survey in the various points of the study area and the other is questionnaire survey.

The physical composition survey was conducted for the determination of the composition of the generated solid waste. Samples were collected from secondary disposal sites (SDS) and door to door collection vans. 10 kg samples were taken from each SDS and vans. The composition of the solid waste in percentage is computed by taking weight of the different components. A questionnaire was prepared for the survey. The study area has the population of 144245 nos. The sample size of the survey was determined by using Solvin's formula. Considering maximum degree of variability and a confidence level of 93%, the sample size is 204 nos. In every ward 24 surveys are made and total 216 nos surveys are conducted. The sample was taken randomly by using random table for getting unbiased result. After the collection of primary data, the raw data were processed by using Statistical Package Software Spreadsheets (SPSS) to meet up the objective of the study.



Figure 3: Satkhira Poursava

3.1.2 Collection of Secondary Data

In addition to the primary data, secondary data were collected from different sources. The information on area, household, population were gathered from Satkhira Municipality authority. Data about the present system of solid waste management, no of dustbin, workers, vehicle etc. were collected from the conservancy sector of Satkhira Municipality. The information about ongoing initiatives on SWM were collected from the town planner of Satkhira municipality.

4. RESULTS AND DISCUSSIONS

For the correct assessment of overall SWM situation in Satkhira municipality it is important to know about the waste generation, waste collection, transportation and disposal, waste

recycling including composting. The data on existing management practices in the study area were collected in various possible ways. A questionnaire was prepared for the survey. The study area have the population of 144245 nos. The sample size of the survey was determined by using Solvin's formula. Considering maximum degree of variability and a confidence level of 92%, the sample size is 209 nos. in total. Here we took the number of participants in the survey was 214 nos. The characteristics of the respondents were as follows. (a) Sex: The nos. of male and female were 81 and 133 respectively, (b) Education: The education level was found as postgraduate 23, graduate 35, HSC 30, SSC 55, Secondary 27, Primary 22 and illiterate 17 nos., (c) Age: The respondents with respect to age group were 1.4% teens, 6.9% adults, 48.6% middle aged, 43.1% senior citizen, (d) Profession: The profession was found as housewife 95, day-labourer 10, shopkeeper 3, service holder 59, business 32, student 9, retired 7 nos., (e) Family Income: The family income of the respondents were 34.3% low income, 49.5% medium income and 16.2% high income. A physical composition survey also conducted to find out the composition of the generated waste.

4.1 Waste Generation

Solid waste is heterogeneous composition of wastes, organic and inorganic, rapidly and slowly biodegradable, fresh and putrescible, hazardous and non-hazardous, generated in urban areas due to human activities (Alamgir & McDonald, 2005). It is, however, difficult to obtain retainable data for quantity and composition of solid wastes generated at different places. This is primarily because most data are based on measurements of waste at the disposal sites (Ahmed and Rahman, 2003). According to Satkhira municipal authority approximately 40 tons of solid waste generates every day. The composition of solid waste depends upon a number of factors such as food habits, cultural tradition, socio-economic and climatic condition. From the physical composition survey composition of generated solid waste was derived (Fig. 5). It is found that among different components the amount of food and vegetables was found to be comparatively higher (68.47%). As it is biodegradable, it can be used to make compost and only 26% being non-compostable. As the large quantity of organic content is present for this it need regular collection and removal.

In a study by JICA (2004) it has been found during wet season the waste generation rate increases by 46%. In another study by Ahmed (1991) this variation was found to be within 15% to 50%. Composition of solid waste varies not only from city to city but even within the same city itself and also seasonally (Enayetullah, Sinha, & Khan, 2005). Satkhira district is traditionally famous for the production, manufacturing and exporting of mangoes in the huge extent. So, it is easily prominent that the composition of solid waste varies in mango and non-mango season. Here, the period from April to August is denoted as the 'Mango Season' and remaining months are 'Non-Mango Season' (Sharholy, Ahmad, Mahmood & Trivedi, 2008). In Bangladesh, the summer starts from April. But the marketing of the mangoes starts with green mango from the midway of March. In March, only 15% of total waste composites with mango waste. The tidal season of the mango production is from May to July because of further warm and interim precipitation. In figure 4 we showed the quantity and variation of Solid Waste generation during both mango and non-mango season.

The mango waste contribution is expressed as the tidal near about one-fourth of total waste generation. Therefore, additional management should be introduced to control the huge amount of mango and mango waste. According to collected data, the annual production of the mango is about 20 million tons in Satkhira town. According to their estimation, 5% of total collected mangoes get rotten and disposed as solid waste. Besides, the post-consumption wastes of mango are mainly seeds called as pit containing kernel and thick peels. The seed represents from 20% to 60% of the whole fruit weight, depending on the variety. The kernel inside the seed represents from 45% to 75% of the whole seed (Maisuthisakul et al, 2009). The peel represents 7% to 24% of the whole weight of mango (Bedardini et al, 2005). According to the available varieties of the mango in Satkhira, the seed contains 50% and the

peel contains 10% of total weight of the mango. In mango season, the average daily mango waste generation is about 8.1 tons which are about 19.3% of daily waste generation. On the contrary, this waste generation tends to become zero as the mango is a seasonal fruit. But the quantity of other waste remains more or less same.

4.2 Waste Collection

A main portion of municipal solid waste is generated from households. After generation of waste householders store waste in different system. From questionnaire survey it is found that 53.7 % household store generated waste in dustbin/basket, 6.9% store in polythene bag, 35.9% in open space and 3.7% do not store at all (Figure 10). From field observation it is found that the storage system is related to the income and socio-economic status. Majority portion of medium and high-income family uses dustbin to store their waste. On the other hand, majority portion (55.4%) of low income family store waste in open place. Most of the people use same storage for both organic and inorganic components. Some inorganic wastes are reusable such as plastic bottles, paper, textile etc. There is an informal sector which contributes a lot to waste management.

4.2.1 Primary Collection & Accumulation

4.2.1.1 Collection of SW from door to door and dustbin

The disposal and collection system in Satkhira Municipality are the conventional process of the dustbin. There is total 110 number of dustbin available in this town of which around 60 dustbins are being used. 9-part time waste collectors cover specific number of household. 13 waste collector work part time to collect restaurant waste specially. They also work in Municipality in master roll. Municipality have more than 70 waste collectors to collect waste from public places and drains. The part time waste collector uses different types of waste collection vans including mechanized and non-mechanized ones, capacity varying from 250-350kgs generally covered or open. Another group of waste collector collect recyclable waste in different modality. They collect directly from households; the maids generally collect them and sell them. About 70 dustbin collectors collect waste from all of the 11 wards every day in the morning. Primary collection time is from 6.30 AM to 10.30 AM. The mango waste is also disposed at the dustbin by both the public and companies. The van unloads the waste to the secondary transport station.

4.2.1.2 Collection of drain sludge and SW by cleansing of drain

The total length of drain of Satkhira municipality is 260 km. Of these 115.24 km of katcha drain, 10.89 km of RCC drain and 58.90 km of brick drain. Satkhira municipality on the supervision of the conservancy department cleans the drain at regular intervals by its sweepers. Sometimes on request or on complain the emergency team of the sweepers clean the drain. The sweepers remove the dug-up materials which mostly compose of grit, sand and decomposed organic substances on the roadsides or the drain sides for drying. After drying within several days, it is transported to the final disposal site by the garbage trucks.

4.2.2 Secondary collection & disposal

After the collection of the SW by the garbage vans the waste are disposed or stored in the SDS or ramps by the garbage vans. There are 5 secondary disposal sites in Satkhira. They are Powerhouse more, Itagacha, Katia, Kukhrali and Terminal more. The municipality has 89 skilled workers, 1 heavy truck having capacity of 4 ton, 2 medium truck with 2.5-ton capacity. Besides it has 8 vans and one alom-sadhu to carry the waste from secondary disposal site to the final dumping station. In Figure 4 some of the vehicles used by Satkhira Municipality

are shown. This project costs the municipality around 390000 taka including all the salary and other expenses.

4.3 Final Disposal Site

Previously there were no final dumping or disposal site in Satkhira Municipality. The municipality often dumped their waste in different places like Labsha, Abader-hat, Bakal etc, and places far from the town. But this was not a very good solution because the waste there remained untreated and hazardous for both man and animal life. So Satkhira municipality has recently taken steps to eradicate this problem. They recently acquired a place having an area of 9.84 acre and declared it as dumping ground of municipal solid waste. Now they have started to dump the waste there.

4.4 Waste Management & Practical Action

“Practical Action” is a non-government organization, working to develop the socio environmental condition of the poor people. Recently they have started a good humanitarian programme in Satkhira municipality. They have combined with another NGO named “Practical Action” and trying to develop the waste management system by helping the conservancy section of the municipality in collecting and disposing the generated solid waste. Previously there was no household or door to door waste collection system in Satkhira municipality. But recently the conservancy section started a joint venture program with “Practical Action” to collect waste from door to door collects SW by door to door garbage vans. It has 10 garbage vans, 10 workers (drivers) work on the garbage vans. Each van collects SW from about 70-80 households. Figure 8 denotes some of the works that Practical Action has performed in Satkhira the workers start collecting waste early in the morning from the households and work till afternoon. Householders collect and store their waste in a basket or bin. The garbage van-drivers come and blow their whistle. The householders drop their collected waste into the garbage vans. The garbage vans carried these waste to the Secondary Disposal Site (SDS) or ramps. But this process is still at its primary stage. They only manage to collect waste from about 700 households. But they have a plan to expand this in other part of the municipality also. The collection workers are not paid by the Satkhira municipal authority. They collect money directly from the household owners. About 50 taka per month is paid by the users. The amount varies from ward to ward, even in the same ward house to house. Not all household uses this service. There is a mix opinion in low income dwellers about the opinion on the payment of the door to door service. But majority portion of medium and high-income community do agree to pay for the service. Practical Action has also set up a Biogas plant to treat the collected household bio degradable waste. In figure 12 some pictures of the bio gas plant taken while we visited the plant are shown. Primarily they have set up a plant having capacity of 50m³ and gave gas connection to 5 houses. The householders are using this biogas for their daily use. The Managing Director of Practical Action has said that he has a plan of expanding the whole program in a broader level.

4.5 Problems & Limitations

Municipalities are unable to achieve its goal of SWM because of lack of technical infrastructure and human resources, relevant data, statistical records, proper planning, insufficient budget, less private participation and unnecessary political interventions (Singh, & Gupta, 2011). Satkhira municipality is trying to develop the condition yet a portion of generated waste remain unmanaged. From the survey it is found that 45% resident are not satisfied with the present SWM system of Satkhira municipality. From the respondents of survey about 14% found the present system satisfied, 38% good and only 3% found it very good (Figure 11). One of the main objective of this study was to analysis the present situation of SWM in Satkhira municipality and find out its lapses and constrains. Residential waste is the main source of MSW in Satkhira municipality. Although municipal solid waste includes both residential and commercial waste, but this study mainly focuses on the

residential waste and exclude other waste such as commercial waste, institutional waste etc. Informal sector plays a vital role in recycling of solid waste. Waste pickers locally known as “Tokai” collect recyclables from the crude dumping sites and sell it to market. Hawkers’ collects reusable and recyclable material such as plastic bottle, paper, textile and metal from the household and sell it to the recyclable market. The SDS of the municipality are located roadside, causing the reduction of effective width. Again, for insufficient space and lack of awareness in garbage van drivers usually waste overflow or deposited at the surroundings. This creates an unhygienic condition and reduce the economic value of the area. There is also lack of awareness in municipality residents. They dispose their waste directly to the drain and cause blockage. There is no local dustbin in Satkhira municipality. It has been observed that people throw waste in the surroundings of the dustbin or in an open place (Figure 9) and many people don’t want dustbin near to their resident. So, who do not use door to door system, have no option than dumping in an open area or in drains. Most of the low-income resident do not want to use door to door service as they have to pay a certain amount per month. So, they dump in open place. As the van puller and helpers engaged in door to door collection system get tinny salary, uncertainty of salary. From the Municipal authority we came to know that they have a long-term plan for upgrading the management system, but lack of proper budget is a great restraint in this path although the annual budget in this sector is at upward direction in the last few years (Figure 13). There is a lack of encouragement to perform the duty properly. The Bio-gas plant of Practical Action is a good opportunity to convert waste into resource. But it is not running to its full potential as yet the municipality do not get the license to sell compost in the market. They are selling compost locally. As the expenditure of the compost plant is derived from the selling of compost, it is becoming difficult to run the plant to its full potential.

4.5.1 Alarming Situation

In Satkhira Municipality there is more or less a good collection and disposal system of both household and market waste, but one of the most alarming news is there is no management system for the waste generated from hospitals and nursing homes. A large portion of the generated Solid Waste remain unmanaged (Figure 14). Medical waste is one of the most problematic types of wastes for a municipality or a solid waste authority. In Satkhira there is 1 general hospital, 1 medical college, 1 veterinary hospital and other about 22 private hospitals which produce a large number of waste. From the physical composition survey, it was found that about 2.5 tons of medical waste generate each day but there is no management system for that. The hospital authority dumps their waste in various places sometimes open places. When such wastes enter the municipality solid waste stream, pathogens in the wastes pose a great hazard to the environment and to those who come in contact with the wastes. Which is a becoming a prominent threat to the city dwellers. The Municipal authority has assured that they are also very concerned about it and are trying to take necessary steps to eradicate this problem.

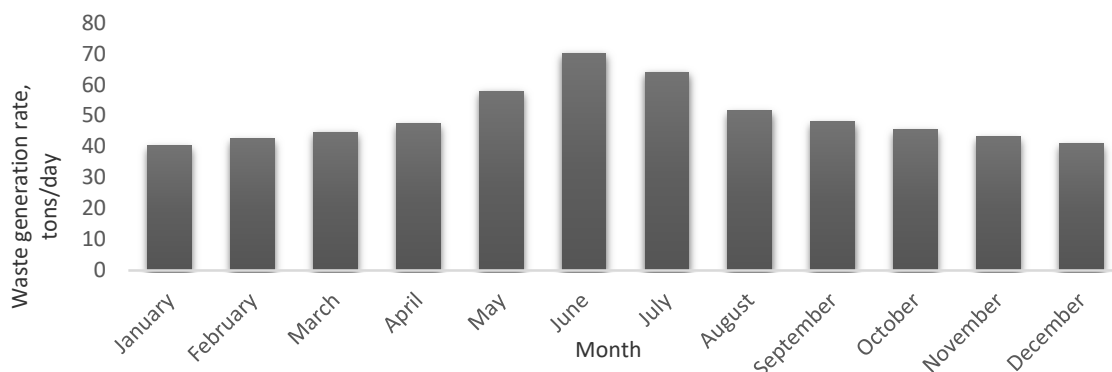


Figure 4: Month wise variation of Solid Waste generation

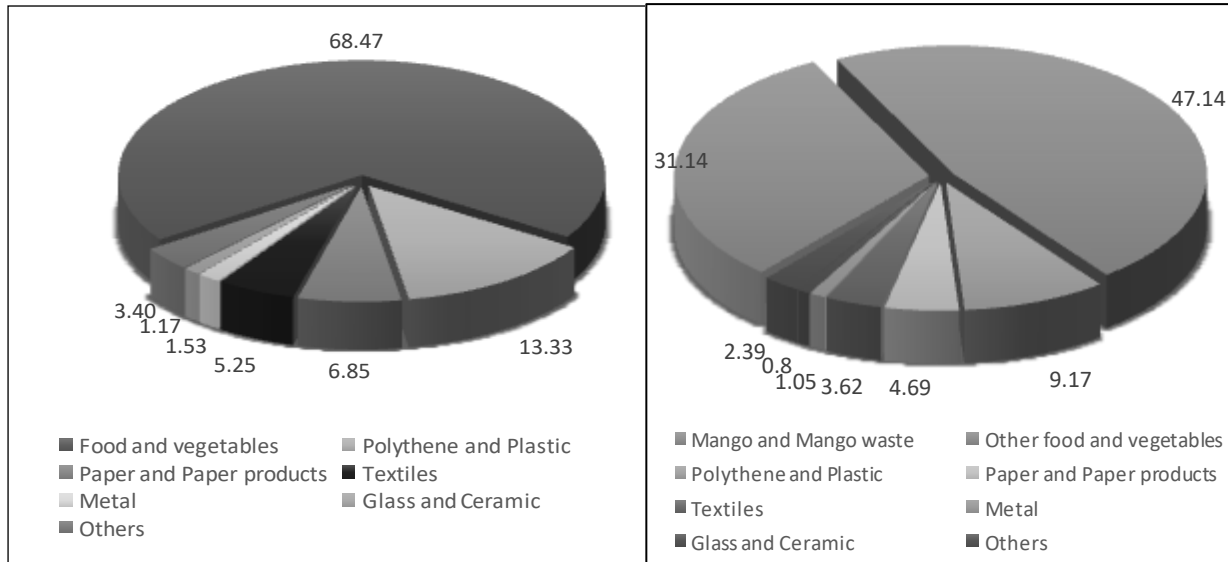


Figure 5 : Composition of SW in non-mango season (left) and Mango season (right)



Figure 6: Different vehicles used by Satkhira Municipality in SWM purpose

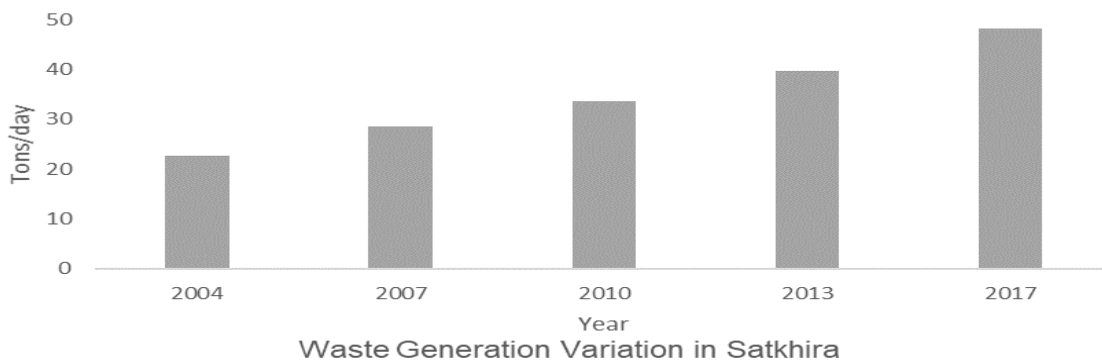


Figure 7: Variation of SW generation during recent years



Figure 8: Some of the contribution of Practical Action in SWM of Satkhira

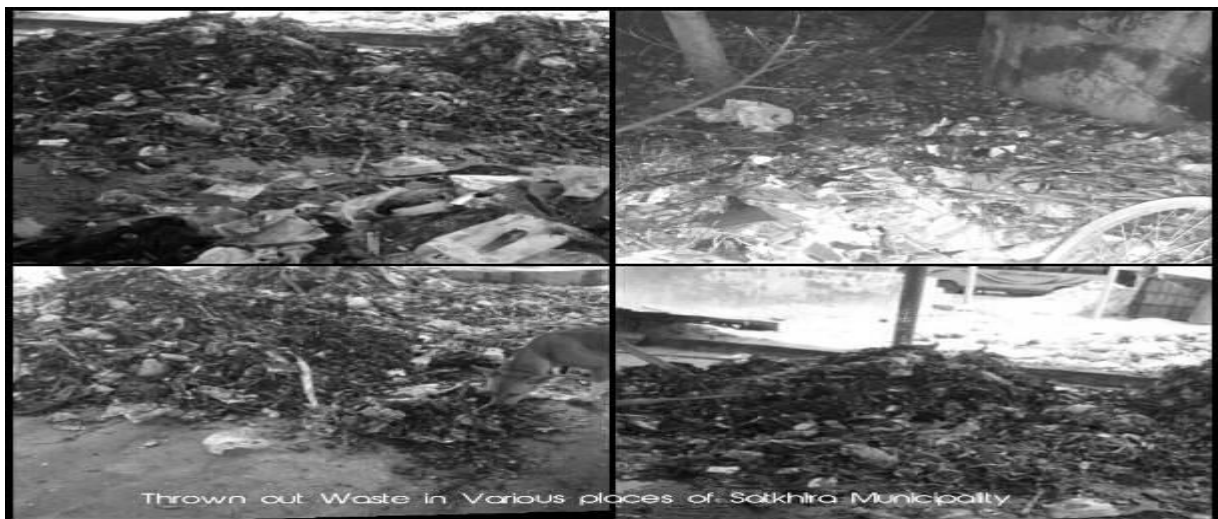


Figure 9: Thrown away waste in different places in Satkhira

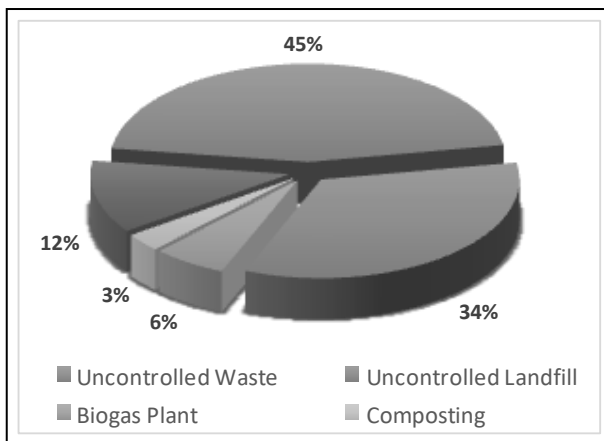


Figure 10: Disposal of produced Solid Waste (percentage) in Satkhira Municipality

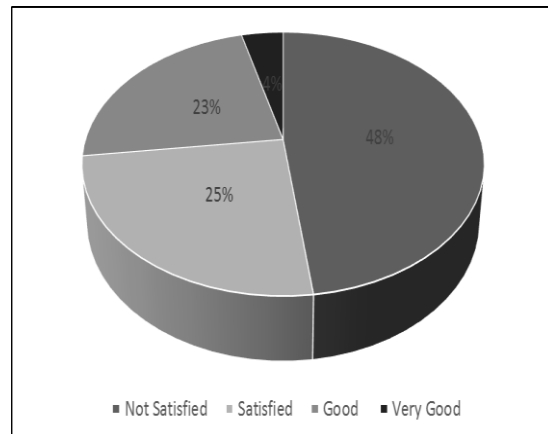


Figure 11: Opinion of the inhabitants about the SWM of SM

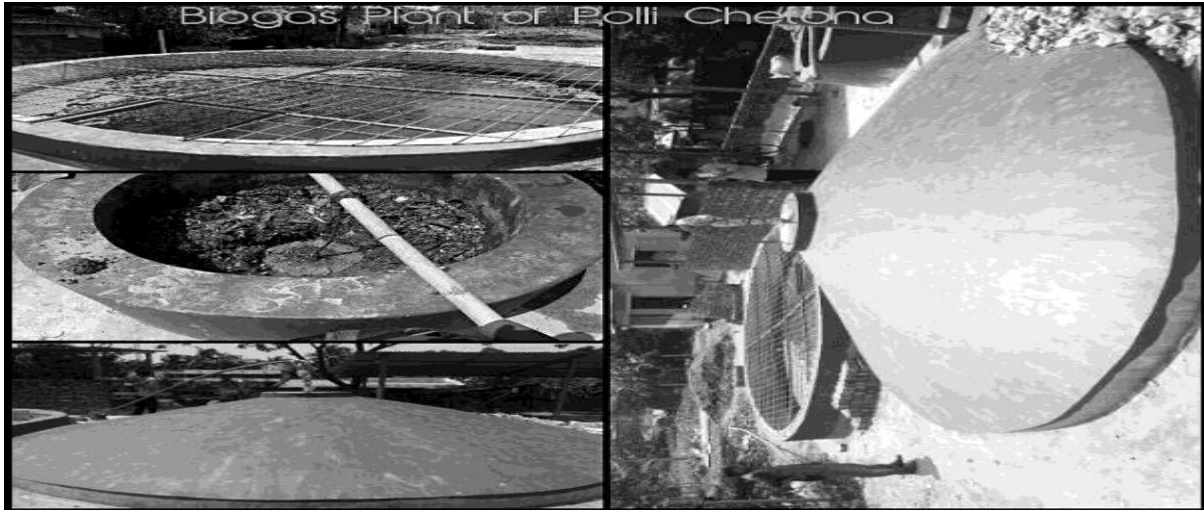


Figure 12: Bio gas plant of Practical Action

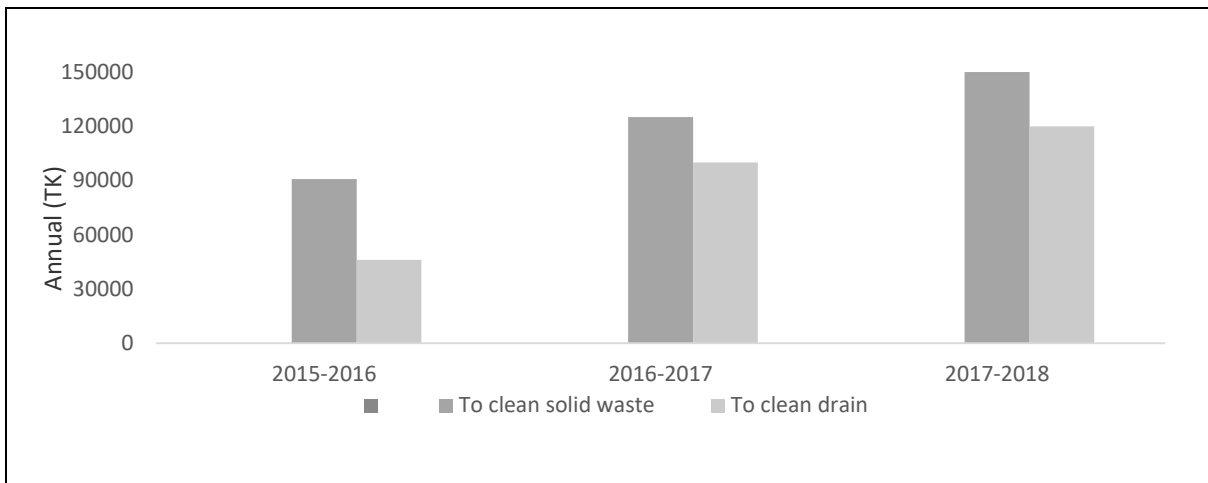


Figure 13: Comparison of annual budget if SP in recent years

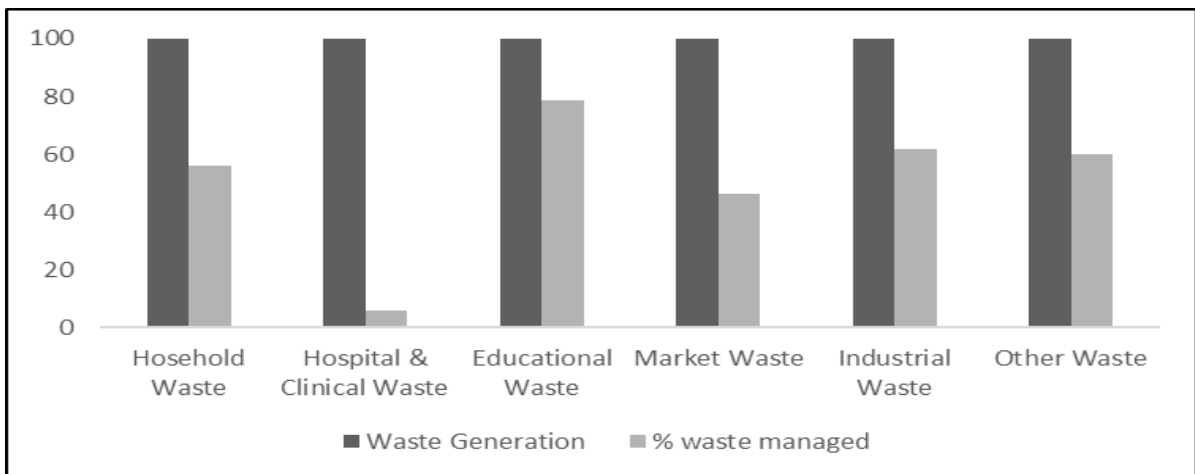


Figure 14: Different types of waste generation vs % managed

5. CONCLUSIONS AND RECOMMENDATIONS

Municipal solid waste management is a complex process because it involves many disciplines and stakeholders. Satkhira municipality is trying to improve its SWM system by adopting new policies such as door to door collection, compost plant etc. After the analysis of the prevailing situation it is found that the present waste collection system of the Satkhira municipality is not fully capable of managing total generated waste. About 10 tons/day waste remain managed. Only 14.6% use the door to door service but the majority portion yet dump waste in open place. The practice of open dumping is high in low income community (about 71.6%). It is also found that majority (62%) of the low-income community wants dustbin as waste disposal system but the scenario is opposite for the high-income community. It is found from the survey that 45% are not satisfied with the present SWM situation of the municipality. A flow path is generated from the study. It is from the flow path that most of the people sell plastic bottles and other recyclables. Informal sector plays a vital role in managing these recyclables. To improve the present SWM situation the municipality may conduct awareness campaign about door to door collection, waste storage, source separation, reduce, reuse, recycle and refuse of waste. From the field survey it is found that there is different opinion about the waste disposal system. Municipality can adopt a mixed waste disposal system considering socio-economic status of the area. A separate department on SWM with more man power can overcome this situation. A vigilant group can be formed in every ward to monitor and improve the SWM of the ward. Particularly, the outcome of this study would provide data for future research and development of SWM in Satkhira municipality.

- To recover this problem, the following things could be done.
- Increase the facility to door to door collection in all areas of Satkhira municipality.
- Sweeping the streets, when the waste is carried on the final disposal.
- The plastic cylindrical dustbin in a street may be covered by a door system to reduce odour.
- NGO participation in SWM practices.
- Public awareness strategy.
- Financial strengthening of local bodies.
- Hazardous waste should be collected and transported separately and disposed of carefully.
- Increase awareness for reduction of solid waste generation.
- Increase awareness to the people about the resource recovery from the solid waste.

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