

## **Municipal Solid Waste Generation and Management: A Case Study of Rangpur City Corporation**

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### **Abstract**

According to Conservancy Authority of Rangpur City Corporation (RCC), about 13 tons of waste is generated daily. About 77 percent waste is naturally compostable in nature. The RCC has no recycling arrangement of its own. However, 151 dustbins were found in different points of 15 wards in RCC, most of those are in bad condition. The 'Nachnia Beel' is a legally recognized waste disposal site for RCC which has no environmental clearance. The survey for this study in 2015 reveals that in RCC many people have no proper idea on municipal Solid Waste Management (SWM). A large number of people drop their waste beside the road and the rest of them manage it personally. Clinical and industrial wastes are not managed by RCC. In spite of containing 151 dustbins, maximum women cannot drop their waste in dustbins due to distance and miserable dirty condition of the dustbin site. Apparently, it is not possible to remove all the solid waste, but it is possible to reduce the bad effect of solid waste by an improved waste management system with public-private partnership.

### **Introduction**

The urban pollution due to increased solid waste (SW) generation is a major concern in both developed and developing countries. The result has negatively impacted on environment, resilience and socio-economic condition. In Bangladesh, solid waste (SW) scenario in urban areas has been changed due to population growth, urbanization and ignorance (Salequzzaman, 2001).

Rangpur is a City Corporation and a newly emerging divisional city which is located at the northern part of Bangladesh. The rural and neighboring people are drifting to Rangpur city from periphery for meeting their needs of growing demands. At this emerging situation, SW generation rate is gradually increasing in different segments (e.g. institution, education center, medical, household, office, market, and industry). The rapid population growth and its unplanned development are significantly attributed to per capita SW generation and improper management strategy. It is critical to make out the overall scenario of SW, e.g. plastic, paper, metal and glass (Rakib, 2003). The aim of this study is to investigate the sources of SW generation and look for a sustained solution on solid waste management (SWM) for RCC.

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### Concept of Solid Waste (SW) and Solid Waste Management (SWM)

Solid waste is any waste generated by everyday human activities. It's may be in the form of household garbage ,leftovers of food and other wastes that included in old houses hold item as papers, plastic in the form of kitchen equipment or any other product that are consumed during daily life.

According to WHO (1971), "solid waste is defined as a useless, unwanted or discharged material and is not free from flowing."

Municipal SW is referred to any non-liquid waste that is created by an individual person, household, small business and institutions, such as school, hospital, clinics and all types of SW generated by the people in a municipal area.

Solid waste management is the generation, prevention, characterizing, monitoring treatment, handling, reuse and residual deposition of municipal SW as like residential, institutional, commercial, agricultural, and special (health care, household hazardous waste and sewerage sludge). The term is usually related to materials produced by human activity, and the process taken by the municipal authority to reduce the impact of waste on human health and the environment.

### Objective and Methodology

The main purpose of this research is to review the existing solid waste management system in Rangpur City Corporation (RCC) and suggest for its improvement.

Methods of the study include empirical field observation and field level data collection with an inventory and questionnaire survey. The survey conducted in order to collect various information from primary source is shown in Figure 1.

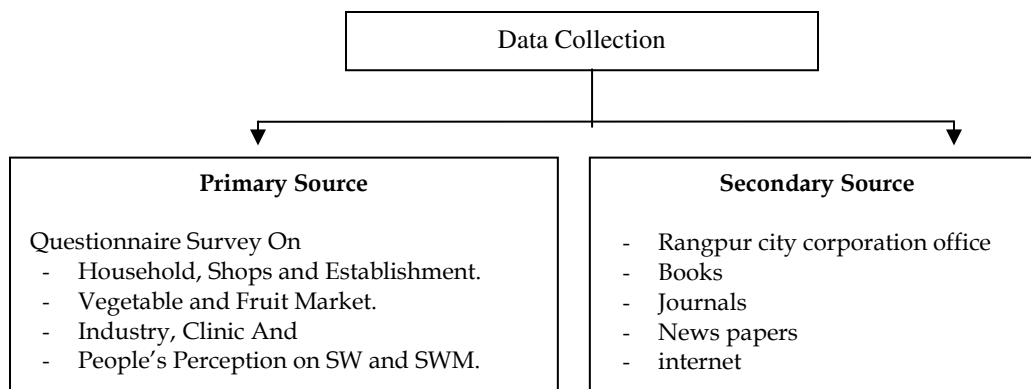


Figure 1: Process of data collection.

Figure 1 shows that data was collected from two sources. The primary source includes households, shops and establishment, vegetable and fruit market, industry, clinic and people and the secondary source includes documents from Rangpur City Corporation, books, journals, news papers and internet.

Of the total sample of 200 included 50 households, 50 shops and establishments, 20 fruit and vegetables markets, 15 industries, and 15 clinics. Respondents' perception on SW and SWM was judged. Data were collected during the period of June to September, 2015.

### People's Perception on Solid Waste Management in Rangpur City Corporation

The Questionnaire Survey reveals people's perception on waste and waste management. It is observed that about 70 people have no idea on the selected terms. It was observed that 17 people have idea below satisfactory level and only 10 respondents have idea that is satisfactory. Only 3 respondents have very good idea and the rest 6 people have good idea. The questionnaire was conducted among 50 respondents.

### Analysis and Findings

The questionnaire survey on solid waste management was conducted in 15 wards of RCC. The analysis and findings are discussed here. Respondent's perception and the activities of RCC on Solid Waste Management (SWM) are analyzed to understand the condition of SWM. The overall result has been presented under two main heads - i) solid waste generation and ii) solid waste management system. These two heads are again discussed through place, frequency and quantity in solid waste generation and dustbin analysis, waste collection period and method in management system (Figure 2).

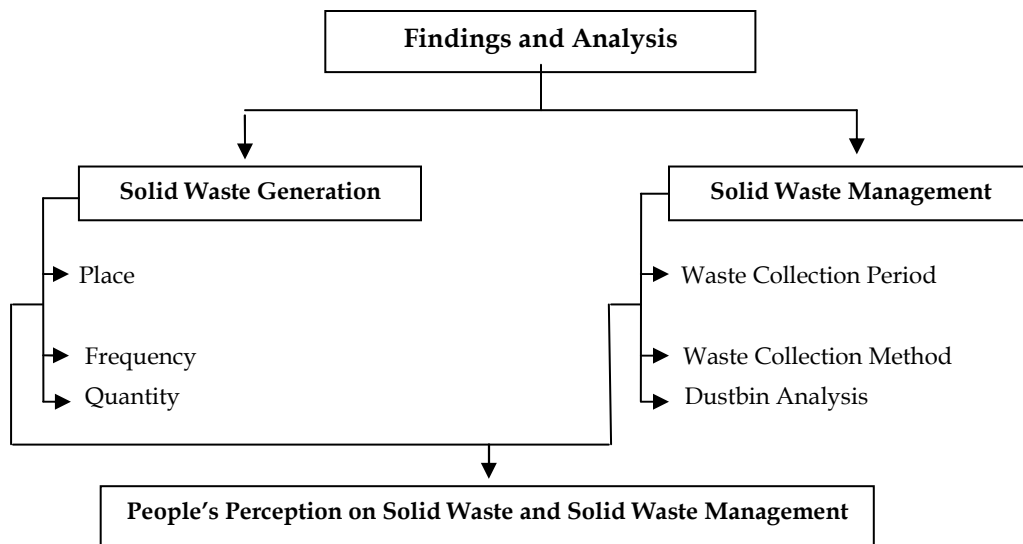


Figure 2: The procedure of analysis of the Study.

### Solid Waste Generation in RCC

#### Sources of Solid Waste

According to questionnaire survey in the study areas, 11.33 percent of the respondents indicated that they used the municipal rickshaw van to drop their wastes as 7.33 percent of the respondents have dropped their wastes in the dustbin. There are also 17.33 percent respondents who used open place and 48.66 percent disposed their solid wastes and the rest of the respondents used other places to dispose solid waste or manage it personally.

Table 1: Place and waste disposal rate for different sources in RCC.

Place	Domestic		Shops and establishment		Vegetables and fruit market		industry		Clinic		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Dustbin	5	10	2	4	---	---	---	---	10	66.66	17	11.33
Rickshaw van /Trolley	3	6	6	12	2	10	---	---	---	---	11	7.33
Open place	7	14	1	2	15	75	3	20	1	6.33	27	17.33
Road side	32	64	40	80	1	5	---	---	---	---	73	48.66
Others	3	6	1	2	2	10	12	80	4	33.33	23	15.33
Total	50	100	50	100	20	100	15	100	15	100	150	100

Source: Questionnaire Survey, 2015

Table 1 shows that waste disposal in the study area varies in terms of different sources of solid wastes. It shows that for domestic waste source 10 percent respondents use dustbin, 6 percent use rickshaw van/ Trolley, 7 percent drop in open places and 3 percent respondents manage it personally.

### Quantity of Solid Waste

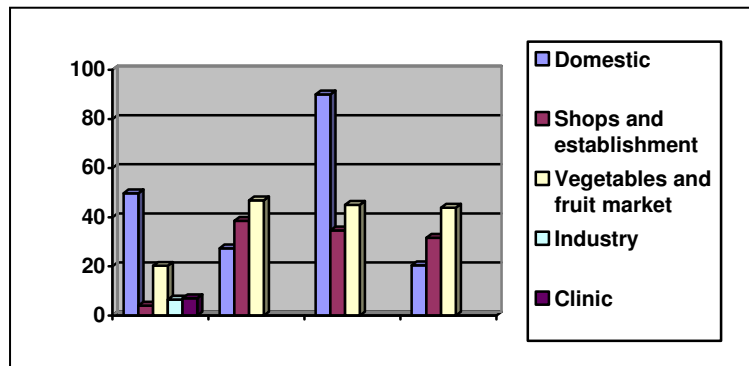
A study sample survey was conducted in RCC representing high, middle and low income groups and markets. Based on that survey, Table 2 shows the domestic waste generation rate of Rangpur City for different income groups as well as the weighted average domestic solid waste generation rate in Rangpur City. It reveals that domestic waste generation rate for middle income group (0.243 kg/cap/day) is the highest in comparison to other income groups. But the difference of waste generation rate between high and middle income group is very negligible (Table 2).

Table 2: Quantity of Solid Waste Generation in consideration of different Income Groups

Income Group	Waste generation rate (Kg/cap/day)	Population (%)	Average domestic waste generation rate(Kg/cap/day)
Low income	0.201	40	0.226
Middle income	0.239	50	
High income	0.243	10	

Source: Field Survey and BMDF, March 2012

Considering the present waste generation rate of 0.241 kg/capita/day and medium growth rate of population, the projected waste generation in Rangpur City Corporation would be 144 tons in 2020, 183 tons in 2025, 232 tons in 2030 and 256 tons in 2032.



Source: Questionnaire Survey 2015

Figure 3: Amount of waste disposals in RCC

According to questionnaire survey in the study area, the amount of domestic waste is in larger portion than others as it covers 49.75 percent of the total amount of solid waste. The waste generation from other sources includes only 4 percent for shops and establishment, 20.25 percent for vegetables and fruit market, 6.5 percent for industrial and 7 percent for clinical waste (Figure 3).

#### Frequency of Solid Waste

The analysis of waste disposal frequency shows the level of awareness of the people in the study area. It was found that 22 percent of the respondents dropped their wastes once in a day. About 46 percent respondents dropped solid waste twice in a day and the rest of the respondents dropped wastes twice in a day without maintaining any routine (Table 3).

Table 3: Frequency of waste disposal in RCC.

	Domestic		Shops and establishment		Vegetables and fruit market		Industry		Clinic		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Per day												
Once	2	4	20	40	10	50	1	6.66	---	---	33	22
Twice	45	90	15	30	5	25	2	13.33	2	13.33	69	46
More than twice	3	6	15	30	5	25	12	80	13	86.66	48	32
Total	50	100	50	100	20	100	15	100	15	100	150	100

Source: Questionnaire Survey 2015

### Solid Waste Management in RCC

#### Waste Collection Period

The respondents in the survey revealed about the time of waste collection by RCC. As much as 51.33 percent respondents of RCC informed that waste is collected in the morning, 19.33 percent said that it is collected in the afternoon, 4.66 percent said that

RCC staff comes to pick waste at night and 24.66 percent said there was no specific time of RCC to collect the waste. It is thus observed that RCC doesn't follow definite routine to collect the waste (Figure 4).

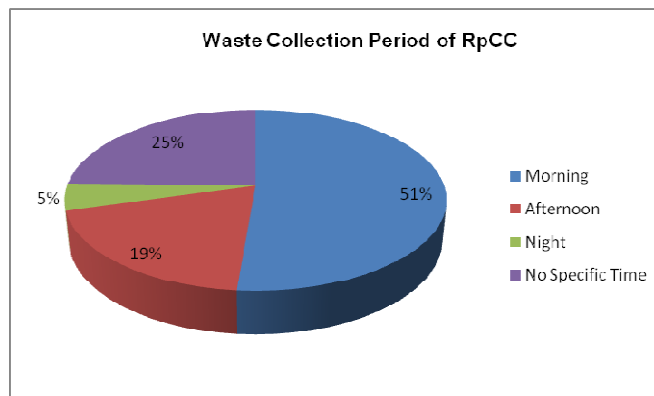


Figure 4: Waste collection period of RCC.

### Waste Collection Method

The solid waste collection method of RCC is varying spatially and socially. It also varies according to the different sources of solid waste (Table 4).

Table 4: Waste collection method for different sources of RCC.

	Domestic		Shops and establishment		Vegetables and fruit market		Industry		Clinic		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Dustbin	3	6	3	6	2	10	----	----	---	----	8	5.57
Fixed point	17	34	25	50	2	10	----	---	---	---	44	30.34
Road side	25	50	23	46	4	20	5	20	---	---	57	37.93
Others	5	10	2	4	7	28	10	80	15	100	41	28.27
<b>Total</b>	<b>50</b>	<b>100</b>	<b>50</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>	<b>150</b>	<b>100</b>

Source: Questionnaire Survey, 2015.

The domestic solid waste survey shows that only 6 percent respondent use dustbins and 34 percent drop their waste in a fixed point, 50 percent drop their waste on road side and 10 percent drop in other unauthorized places. The response from shops and establishment survey shows that 6 percent use dustbin and 50 percent drop their waste in a fixed point. It is notable that 46 percent respondent manages their waste personally. The vegetables and fruit market survey shows that only 10 percent use dustbin, 10 percent drop their waste in a fixed point, 20 percent drop on road side and the rest 28 percent manage it personally. The industry survey shows that 5 percent respondents drop their waste on road side and 10 percent manage it personally. It is revealed that

there is no dustbin and fixed point to drop their waste. The clinical survey shows that clinical authorities manage their waste individually through their own management systems. The overall solid waste management system of RCC as revealed from the survey is shown in Figure 5.

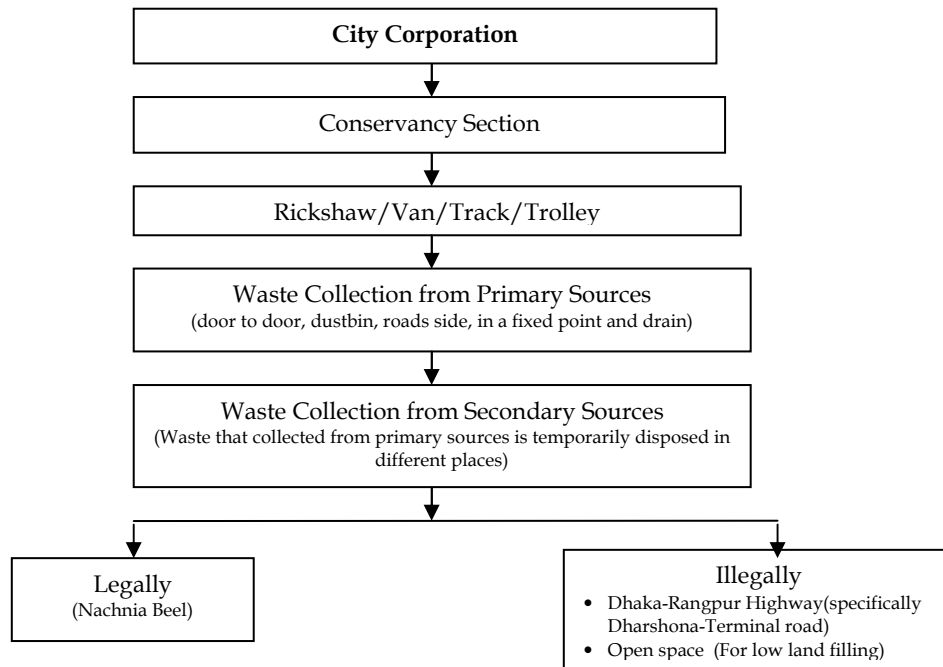


Figure 5: Solid waste management method of RCC.

### Dustbin Arrangement

RCC set up different types of dustbin in different places for collection and management of solid waste. The questionnaire survey shows that about 16.44 percent use 'ring dustbin' and the user of 'dhalai dustbin' is 14.38. Use of broken dustbin is 10.27 percent and 35.62 percent has no any dustbin, whereas 23.29 percent manage their waste personally beside their house (Table 5).

From Table 5, it is observed that the types of dustbin used by the respondents in RCC vary spatially and socially. For domestic solid waste sources, the survey shows that 44 percent use "ring dustbin", 20 percent use 'dhalai dustbin', whereas 22 percent has no dustbin for waste disposal. About 8 percent people personally manage their waste near their house. Shops and establishment survey shows that 16 percent respondent use 'dhalai dustbin'. Again, 6 percent respondent said they use 'broken dustbin'. It is notable that about 28 percent respondents have no dustbins and 50 percent people manage their wastes personally. The questionnaire survey on vegetables and fruit market shows that 10 percent use 'ring dustbin', 15 percent use 'dhalai dustbin' and 20 percent have no dustbin. It is important to note that 50 percent respondent personally manage their waste in unauthorized places. The industrial solid waste survey shows that 46.66 percent has no dustbin and 20 percent use 'broken dustbin', about 33.33 percent industry manage their

waste individually in their own land. From survey on clinical waste, respondents said that they have no permission to drop their clinical waste anywhere in RCC. The clinical waste has the possibility of harming people and the environment.

Table 5: Types of dustbin of RCC.

TYPES	Domestic		Shops and establishment		Vegetables and fruit market		Industry		Clinic		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ring	22	44	---	---	2	10	---	---	---	24	24	16.44
Dhalai	10	20	8	16	3	15	---	---	---	21	21	14.38
Broken	3	6	3	6	1	5	3	20	---	15	15	10.27
No dustbin	11	22	14	28	4	20	7	46.66	---	52	52	35.62
Others	4	8	25	50	10	50	5	33.33	15	34	34	23.29
Total	50	100	50	100	20	100	15	100	15	150	150	100

Source: Questionnaire Survey, 2015.

### Analysis of Total Capacity and Solid Waste Generation of RCC

Ten dump trucks, each of 3 ton capacity were found in good condition and regularly operable in Rangpur City Corporation. Almost all of the dump trucks in operation are being used every day. Six trucks work at night and make a total of about 18 to 24 trips. In some cases, dump trucks make 4 trips but mostly they make 3 trips per day. One is allocated for medical college hospital and another one is assigned for cantonment area. Chief Conservancy Officer (CO) controls the overall waste collection and transportation management including all equipments. All wards of RCC do not have Conservancy Inspectors (CI) but supervisors who work under the direction of CIs. One CI supervises at night whether all the vehicles in whole city work properly or not under the instruction of CO. It was found that dump trucks can make 4 trips per day, according to time and motion survey.

The existing dump truck capacity potential for 3 ton vehicle is 72 Ton/day considering trucks that are making 3 trips per day. If the trucks can make 4 trips per day, the theoretical capacity of dump truck of RCC is 96 ton/day. However, in practical, a rational management system should not deploy its entire vehicles. Some vehicles always need to be kept as back up for emergency operations as sometimes working vehicle might go out of order or during VIP visit when special cleaning is required, special days cleaning program like national victory or independence day, Eid Day waste management and so on. The allocation of dump trucks is mostly uniform and does not vary day to day. The driver and cleaners in the daily work of a dump truck is almost same. From the time and motion survey, the dump truck (3T) was found to make 4 trips per day. The working time of the workers was around 6.5 hours. However, in this time 5 cleaners and 1 driver worked for 4 trips. It was not reported that any of staffs/workers get overtime allowance. The waste carriage was found around 2.7 on/trip/night or 10.8 ton/night for



traveling around 102 km Total number of secondary points covered was 7(Field Survey BMDF, June 2012 and Shah M. R. M,Jui Z. F.and Nayan R. M, Feb. 2015).

### Projection

For the sake of advantages of the work, the Questionnaire Survey 2015 had been conducted among only 50 respondents from 5 main sources like household, vegetables and fruit market, industry and clinic if we convert this result (in Figure 6) to 100 percent it will be 34% = No idea, 34% = idea with below satisfactory, 20% = satisfactory, 12 % = good and only 6% = very good.

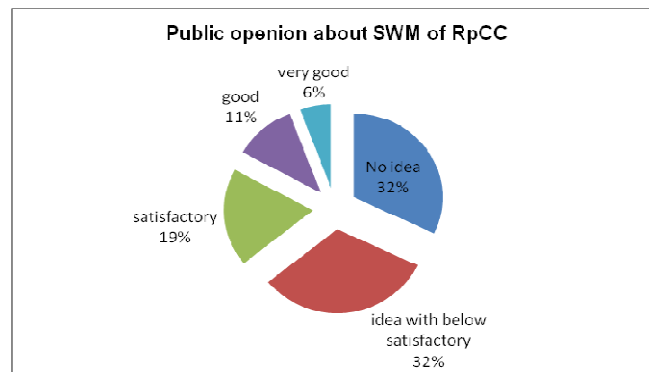


Figure 6: Public opinion about SWM of RCC.

The total projected population of the RCC in 2015 was about 4, 71,373 in medium (4.899%) growth rate. Then the result stands up as 6% =28282.38 = Very good, 12% = 56564.76 = Good, 20%= 94274.6 = Satisfactory,34% = 160266.82 = Idea with below satisfactory, 34% = 160266.82 = No idea.

### Recommendations

The steps that can be adopted for improvement of solid waste management system in Rangpur City Corporation are provided here based on this research.

- Enough financial and logistic support for this city is required.
- Enough scientific and technological facilities have to be placed to manage solid waste in an environmental friendly manner.
- Adequate public awareness programs should be taken about environmental and health problems associated with solid waste through:
  - Radio and TV, Mosques, Temples and other religious organizations.
  - Govt. and NGO's initiatives.
  - Making local image and posturing.
- Most municipal drains that are incomplete create water logging during rainy season and make urban life painful. So, these drains should be completed as early as possible.
- Proper maintenance of landfill by assigning the skilled workers.
- Terminal to Goneshpur road is broken and miserable in condition, which make dust

- combustion in dry season and should be repaired.
- Engaging enough traffic police and speed breakers.
- Gas supply that are in hanging still now should be implemented as early as possible
- Good communication and formality should be developed in indoor section of the City Corporation that will be helpful to the overall management for all
- Sustainable land management should be taken for the waste disposal site such as Nachnia Beel
- Environmental Impact Assessment (EIA) should be taken for land, water and air of the city
- 3R (Reduce, Recycling and Reuse) strategy must be followed.
- Implementing organic and compostable fertilizer that would come from these municipal wastes.
- Establishment of ICT (Information and Communication Technology) specifically for the conservancy section.
- There have to develop well managed co-ordination of the public and private sectors
- Needs to develop proper institutional setup at the local government level

### **Conclusion**

The study was conducted on the solid waste generation and management in Rangpur City Corporation. As an emerging City corporation, Rangpur is important to make out the mandatory prerequisite conditional factor such as planning and existing environmental condition. The anthropogenic stress is interfering with environmental and its components directly and indirectly. The existing management approach of the study area was not so enough to well organize and congenial to environmental health results showed that solid waste generation rate has increased owing to population growth and urban development.

Rangpur City Corporation has an area of 50.66 sq. km. with 15 wards. The entire area is served by 221.25km pucca and 45km katcha road networks. There are about 55km pucca and 170km katcha drains in RCC. Solid waste collection and disposal is the responsibility of conservancy section of RCC. There are about 200 waste collection points, 06 public toilets and a landfill site in RCC. There are 7 katcha bazaars and 140 hospitals and clinics in the city.

Rangpur is an emerging city. After recognition as a divisional city, it faces various problems due to increase of city population including regular commuters to the city from the peripheral areas for various purposes. Increasing population produces huge wastes daily. But RCC does not take proper and organized system to manage this huge garbage.

As a newly emerging city, the waste management system of RCC is going on by various processes of implementation. The City Corporation has some weaknesses in its Conservancy Section, such as poor funding, lack of skilled labor force and the unawareness of both the common people and the RCC authority. There are some foreign and non-government organizations (NGOs), like JICA, ADB and SOPNO, which are

already involved to manage the waste of RCC through various developing projects. The questionnaire survey reveals that there are five main sources of solid wastes, such as domestics, shops and establishment, vegetables and fruit market, industry and clinic. Among them, domestic sources are more than half of the total generated solid waste, secondly, wastes from the vegetables and fruit market covers the one-fourth of the total amount. The common people are not satisfied to the service of RCC on waste management service. They have some objections such as:

- RCC does not collect the waste regularly.
- They have not sufficient number of dustbins. So they cannot put up their waste in a fixed point. Sometimes, they have to manage it personally beside the road or unauthorized place near their house.
- RCC does not clean the drain regularly.
- Mayor said that RCC collects the waste early in the morning regularly. But maximum people drop their waste after 10.00 am that creates mismanagement to RCC to waste collectors.
- Due to distance of the nearest dustbin, maximum women drop their household waste near to dustbin but not at the just point in the dustbin that make a problem of bad odor regularly and affects the surrounding environment.
- Road side waste disposal is not good for the environment. It happens without the knowledge of the RCC authority by the open truck drivers. Some land-owners are eager to fill their land with wastes.

It can be said that RCC should pay more attention for the sake of common people as city dwellers. With the rapidly growing population, it is really impossible to make this city fully waste free, but a planned solid waste management system can reduce the waste problem and improve the urban life of the city. Since Rangpur City Corporation lacks financial capacity to undertake major project on SWM, the governmental support is necessary. Finally, awareness of the city dwellers is important in the drive to keep the city clean.

### References

- Ahmed and Feroze M. 1985. "Waste Disposal and Degredation of Water Quality in and around Dhaka City", in Islam A. S., Proceedings of the seminar on Protection the Environment from Degredation, Science and Technology Division ,Ministry of Education and Government of The People's Republic of Bangladesh, May 13-16, Dhaka, Bangladesh, pp 167-178
- Agamuthu, P. 2003. "Solid Waste Management in Developing Economies -Needs for a Paradigm shift on waste management and research", 21 (6) (2003), pp 487-497
- Bangladesh Bureau of Statistics (BBS), 2002. A Statistical Pocket Book of Bangladesh.
- Bari Q. H. 2012. "Solid Waste Recycling in Rajshahi City of Bangladesh, Waste Management", 32:2029-2036
- B MDF, 2012. "Study on Municipal Solid Waste Management for Chittagong City Corporation, Rajshahi City corporation, Rangpur Municipality and Potuakhali Municipality", Bangladesh Municipal Development Fund (B MDF).

- Cointreau S. J. 1986. "Environmental Management of Urban Solid Waste in Developing Countries". Government of the Bangladesh (GoB), 2010. "Draft solid Waste Management Handling Rules ", Ministry of Environment and Forest
- Hasan G. M. J. and Chowdhury M. A. I. 2005. "Municipal Waste Management Environmental Hazards in Bangladesh, Pakistan", Journal of Biological Science, 8 (6): 921-928.
- Salequzzaman M. and Awal M. 2001. "Willingness to pay: Community based solid waste management and its sustainability".
- Shah M. R. M, Jui Z. F. and Nayan R. M. 2015. "Case Study on the recent solid waste management scenario in Rangpur city", the Waste Safe 2015-4<sup>th</sup> International Conference on Solid Waste Management in the Developing Countries, 15-17 February 2015, ISBN: 978-984-33-8695-3, Pl. 122