ISBN 978-93-84422-57-8
Proceedings of 2015 International Conference on Disaster Management in Civil Engineering (ICDMCE'2015)
Phuket, Thailand, October 1-3, 2015, pp. 87-92

Solid Waste Management in Chittagong City

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Abstract**:** *The consumption habits of modern consumer lifestyles are causing a huge worldwide waste problem. Having overfilled local landfill above capacities, many first world nations are now exporting their refuse to third world countries. This is having a devastating and adverse impact on ecosystems and cultures throughout the world. Now more than ever it has become a matter of concern for any developing country such as Bangladesh. But the good news is that new ways are being developed to recycle waste to decrease the dangerous health and environment effect it causes . With a population of 160 million, Bangladesh produces a large amount of waste daily which can be recycled and can be further used through step to step management and implemented elsewhere by prior treatment. But do so we require a suitable plan and organizations and waste management facilities with adequate man-power. With consumer products evolving and being more sophisticated the wastes too contains rather high amount of toxic substances. So by conducting a survey throughout Chittagong city we have drawn the conclusion to a more effective management to create a clean and healthy environment*.

Keywords: *landfill, waste, recycle, management, toxic substance etc.*

1. Introduction

Bangladesh, a developing country ,having a population over 170 million produces almost 2200-2400 ton waste per day per city. In this rapid growth in population and demand , It is becoming a challenging task to manage wastes that are being produced daily by the authorities. The task of waste management is handled by the City Corporation and Municipalities. The waste quality of Bangladesh has more moisture content due to the habitual behavior of the people. This incapability is managing the excess load of waste produced is creating a threat to the overall sanitation. Chittagong is one of the fastest growing city of Bangladesh that contributes about 15% of the total waste. Due to having more moisture in the wastes incineration process is used to burn the wastes in furnaces. But the studies now show that even segregation method can be applied for these waste management.

2. Identification of the area

2.1. Location

Being established in 1894 Chittagong Municipality was upgraded to City Corporation in July 1990. It was reconstituted to Chittagong Municipal Committee under the Municipal Administration ordinance of 1960. After the independence of Bangladesh Chittagong Municipal Committee was renamed as Chittagong Municipality. The Chittagong City Corporation is the second largest city corporation with an area of 168.07 sq. km. According to the 2001 census about 55 percent of the population is male with Literacy rate (more than 7 years old) 65% according to the 2001.[1]

The City Corporation consists of 11 thanas namely BaKalia, BaijidBostami, Halishahar, Khulshi, Chittagong port, Pahartoli, Double Mooring, Kotwali, Panchlaish, Chadgaon, and the Hathazari and 207 mahallas containing 41 wards. There are 389 educational institute, 110 clinics/hospitals, 38 playgrounds, 55 public toilet,

12 cinema halls, 76 community centers, 6 dakbunglows, and 52 post offices in this city corporation. Figure 1shows the map of Chittagong City Corporation..[1]

2.2. Chronology of Population Growth in Chittagong City Corporation

Past census data of Chittagong City Corporation reveals that there has been a sharp increase in population from 1981.The average annual growth rate of Chittagong City Corporation for the 1981-2001 -census year was 4.862%. Total population of Chittagong City Corporation in the census ,the year 1991 and 2001 were 1,392,860 and 2,023,489 respectively, which shows a population growth rate nearly about 4.53% per annum. During the same period national urban population growth rate was 3.27%. Although the area coverage of Chittagong City Corporation decreased about 41.6 sq. kilometer from 1991 to 2001. population growth rate increased about 0.95% in comparison to the previous decade .To quantify the amount of waste generated in CCC as well as to identify the infrastructure need, we have considered 2001 census population of 2,023,489 as the base population .

Projected population for Chittagong City Corporation up to 2032, based on three types of growth rates – low (3.577%), medium(4.527%) and high (4.863%) growth rates. the present population of Chittagong City Corporation in year 2012 stands 2,978,711, 3,293,372 and 3,411,339 respectively.[1]

There is a table I which consists of 11 thana's name, population ,area, density and the changing rate is given below:[2]

TABLE I: Population ,area, density and the changing rate of Chittagong City Corporation

Thana's Name	Are a(km^2)	Population Census 1991-03-13	Population Census 2001-01-22	Population Census 2011-03-15	Density (inh./$km^{2)}$	Changing Rate %/year [2001-2011]
Bakalia	12.13	113,446	196,877	262,703	21,657.3	+2.89%
Bayejid Bostami	17.58	121,827	168,051	211,355	12,022.5	+2.29%
Chandgaon (Chāndgaon)	25.32	111,210	178,390	256,411	10,126.8	+3.64%
Chittagong Port (Bandar)	20.04	108,816	213,598	208,260	10,392.2	-0.25%
Double Mooring	8.12	222,165	259,181	361,154	44,4771	+3.33%
Halishahar	9.64	73,993	125,255	151,515	15,717.3	+1.89%
Khulshi	13.12	152,657	243,351	278,623	21,236.5	+1.34%
Kotwali	7.68	201,175	282,975	319,972	41,663	+1.22%
Pahartali (Pahārtali)	13.31	95,618	127,243	190,637	14,322.8	+4.07%
Panchlaish	8.3	113,127	148,120	219,132	26,401.4	+3.94%
Patenga	32.65	78,924	80,448	132,677	4,063.6	+5.06%

In the event of rapid development a high growth rate of population may be anticipated, which will cause rise of population to 8.82 million by the year 2032. Under medium growth rate, the population is estimated as 7.98 million, while the population under low growth rate is estimated at 6.02 million for the year 2032.

3. Objectives and Methodology of the Study

There are two basic objectives of the study which are - i) to find out what initiatives and measurements can be taken and to find out proper survey report on how to plan to make use of organic solid waste materials to make compost fertilizer in Chittagong City and ii) to determine the importance and functions and to specify the demand of compost fertilizer in the market.[4]

In this study, secondary data is collected from Chittagong Development Authority (CDA), Chittagong City Corporation (CCC) and related reports and research papers. Key Informants Interview (KII) method is used to collect data from peoples engaged in different jobs. Questionnaire survey is also conducted to collect data from the people located in Chittagong city and adjoining areas. A total of 11 thanas are selected randomly as a representative of Chittagong city and adjoining areas.[4]

TABLE II: The per capita waste in Chittagong City

Population In Lie	Average per capita waste generation (kg/capita/day)
01-05	0.21
05-10	0.25
10-20	0.27
20-50	0.35
50+	0.5

4. Quantity of Waste

No reliable data is available as to how much waste is generated in the study area. Following Table shows the per capita waste in Chittagong City[3]:

TABLE III : Domestic Waste Generation Rate of Chittagong City Corporation

Type of Population	Generation Rate (kg/cap/day)
Low Income	0.234
Middle Income	0.270
High Income	0.281

In order to determine the actual waste generation rate, a sample survey was conducted at each of the City Corporations and Municipalities representing high, middle and low-income groups

4.1. Quantity of Waste in Chittagong City Corporation

A sample survey was conducted in Chittagong City Corporation representing high, middle and low-income groups and vegetable markets.

Based on that survey, Table III shows the domestic waste generation rate of Chittagong City Corporation, which reveals that domestic waste generation has positive correlation with income level[1].

TABLE IV: Average Domestic Waste Generation Rate in Chittagong City Corporation

Type of Population	Waste Generation Rate (kg/cap/day)	Population(%)	Average Domestic Waste Generation Rate (kS'cap/day)
Low Income	0.234	40	
Middle Income	0.270	50	0.257
High Income	0.281	10	

It has been found that in urban areas of Bangladesh on average 40% of the total population belongs to low-income, 50% in the middle income group, while 10% in the high-income group (Source; The Daily Star June 27, 2009; Article on Urban poor by Nazrul Islam, Salma Shafi and Moniruzzaman). Considering this, the weighted average domestic solid waste generation rate in Chittagong City Corporation area has been calculated and presented in Table IV [1]

Expenditure & Income From SWM In Chittagong City Corporation

A total of 2859 officers, other staff and workers are engaged m SWM in CCC - 2060 in conservancy section, 200 drivers working in mechanical engineering section, 73 in mechanical workshop, 26 in compost plant, 500 under civil engineering section for cleaning of large drains. A major portion of the total expenditure made in SWM is basically consumed by the component of salary & other allowances against the engaged manpower

Table V below depicts the expenditure of CCC in SWM under the head of salary, wages and other allowances[1].

TABLE V: Expenditure of CCC in SWM under the Head of Salary. Wages and Other Allowances

SL. No.	Designation	No. of Staff	Avg. Individual Salary per Month (Taka)	Total Annual Salary (Taka)
Conservancy Section				
1	Chief Conservancy Officer	1	18,048	216576
2	Conservancy Officer	2	18,048	433152
3	Conservancy Superintendent	8	16,998	1631808
4	Conservancy Inspector	23	16,888	4661088
5	Conservancy Supervisor	52	16,339	10195536
6	Group Leader	11	15,688	2070816
7	Permanent Conservancy Workers	406	9000	43848000
8	Temporary Conservancy Workers	1557	6,000	112104000
A	Sub-Total	2060		175160976
Mechanical Workshop (for Conservancy Purpose):				
1	Sub-Assistant Engineer	3	10,000	360000
2	Foreman	2	12,000	288000
3	Mechanic	30	8,000	2880000
4	Mechanic Helper	15	6,000	1080000
5	Welder	3	12,000	432000
6	Welder Helper	2	6,000	144000
7	Painter	4	6,000	288000
8	Cleaner	6	6,000	432000
B	Machine Operators	8	8,000	768000
Compost Plant				
1	Project Manager	1	12,000	144000
2	Project Engineer	1	1 5,000	1 80000
3	Sub-Assistant Engineer	1	14,000	168000
4	Foreman	1	7,500	90000
5	Electric Helper	1	6,000	72000
6	Fitter	13	7,500	90000
7	Worker	7	6,000	936000
8	Security Guard	26	6,000	504000
C	Sub-Total			2184000
Engg Section				
1	Drivers	200	8,000	19200000
2	Large Drain Cleaning Workers	500	6,000	18000000
D	Sub-Total	700		37200000
E	Total Staff Salary	2859		221216976
F	Salary Overhead (Other Allowances -20%			44243395
G	Total Expenditure for SWM Personnel			265460371

Table V depicts that CCC expends Taka 221,216,976 per year for the manpower engaged in SWM. In addition, 20% has been added with this amount for catering the festival bonus for staff, gratuity for retired personnel and also considering emergency need for additional workers. Adding the overhead, the total expenditure for SWM personnel in CCC stands at Taka 265,460,371.

CCC has to spend a lot of their money on these extra expenditures. These expenditures include rents and bills and also other official bills. Apart from salary, wages and overheads, there are certain other heads, on which CCC has to spend for SWM.

The new pay scale was not established at the time of survey .so, there were used available the previous pay scale.

Table VI below shows the estimated budget expenditure of CCC on SWM for the current financial year[1],

Table VI: Budget Expenditure of CCC on SWM for Year 2011-12

Particular	Expenditure (Tak.a)	Percentage
Salary & Allowances	262,500,000	63.47
Repair & Maintenance	10,000,000	2,42
Rent	17,500,000	4.23
Electricity, Fuel, Water	40,000,000	9.67
Postal, Telephone & Other Communication Expenses	500,000	0.12
Tour & Conveyance	50,000	001
Advertisement & Awareness Building	2,000,000	0.48
Printing	1,000,000	0.24
Training	25,000	001
Storage	80,000,000	19.34
Total Expenditure	413,575,000	100.00

Table VI depicts that total expenditure budgeted for SWM in the current financial year for CCC is Taka 413,575,000, of which 63.47% is consumed under the head of salary & allowances, while the other important expenditure heads are storage (19,34%), electricity, fuel, water (9.67%) and rent (4.23%) respectively.

Financial analysis has been made by using data on population, waste disposal and expenditure on SWM by CCC and then management costs per ton and per capita have been calculated. The financial analysis has been presented in Table VII below [1]:

TABLE VII: Financial Analysis for Total Disposed/Dusposed Waste (with Estimated Annual Income)

Table VII reveals that the annual budgeted income from waste management sector is Taka 1133.15 per ton against the daily dumped 490.5 tons of waste, which is even much less than half of the cost incurred for the purpose. On the other hand, the per capita income in solid waste management sector per year stands Taka 59.47 for the population of 3,411,339 in Chittagong City

5. Conclusion

A continuing rise in the rate of waste production is no longer acceptable – hazardous waste affects the health of millions of people and poisons large areas of our planet. In many places people live surrounded by garbage and landfills. It is essential that governments and corporations face up to waste, using what we know about

Population	Total Waste Disposed (ton)	Income from SWM Million Taka)	Income from SWM (Tk./per ton)	Per capita / Year (Tk.)
2,978,711	490.5			68.11
3,293,373		202.87	1133.15	61.60
3,411,339				69.47

reduction, recycling and reuse, but also developing new technologies that eliminate waste. this method is applicable for any counties all over the world specially for the developing country like Bangladesh. This method should be applied as soon as possible and every city government should encourage this method.

6. Acknowledgements

The authors are grateful to the owners of the AQUA Consultant & Associates Ltd. (BD) ,Hifab International AB, Sweden Resource Planning and Management Consultants Ltd. (BD),Engineering & Planning Consultants Ltd. (BD**)** and the government office Chittagong Development Authority for allowing their employees to participate in the survey.

7. References

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