A COMPARATIVE STUDY ON MUNICIPAL WASTE MANAGEMENT OF DHAKA CITY

By

IMAM MEHEDI HASAN

MD. ABDUL RABBI

TUTUL KUMAR

NOYON MONY CHAKMA

A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering



Department of Civil Engineering

Sonargaon University

147/I, Green Road, Dhaka-1215, Bangladesh

Section : (22B)

Semester -Year : Summar-2024

A COMPARATIVE STUDY ON MUNICIPAL WASTE MANAGEMENT OF DHAKA CITY

By

IMAM MEHEDI HASAN : BCE2001019217

MD.ABDUL RABBI : CE2101022123

TUTUL KUMAR : CE2101022065

NOYON MONY CHAKMA: BCE2001019083

ANGILA TABASSUM
Assistant Professor Department of Civil Engineering.

A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering

Department of Civil Engineering

Sonargaon University

147/I, Green Road, Dhaka-1215, Bangladesh

Section: 22B

Semester Year: Summar-2024

BOARD OF EXAMINERS

The thesis titled " MUNICIPAL WASTE MANAGEMANT OF DHAKA CITY" Submitted by IMAM MEHEDI HASAN_BCE200101217, ABDUL RABBI_CE2101022123, TUTUL KUMAR_CE2101022065, NOYON MONY CHAKMA_BCE2001019083,has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering on 27-09-2024 Date-of-Defense.

……

ANGILA TABASSUM

Assistant Professor, Department of Civil Engineering. 147/I, Green Road,Dhaka-1215,Bangladesh — Chairman

……

Internal / External Member — Member

……

Internal / External Member — Member

DECLARATION

It is hereby declared that this thesis/project or any part of it has not been submitted elsewhere for the award of any degree or diploma.

STUDENT NAME:	**STUDENT ID.:**	**SIGNATURE:**
IMAM MEHEDI HASAN	BCE2001019217	
ABDUL RABBI	CE2101022123	
TUTUL KUMAR	CE2101022065	
NOYON MONY CHAKMA	BCE2001019083	

Dedicated

To

"OUR PARENTS"

ACKNOWLEDGEMENTS

We are deeply grateful to our advisor, ANGILA TABASSUM, for their patient guidance, enthusiastic encouragement, and insightful feedback. We would not have been able to complete this paper without their support. We would also like to thank the members of our team members for their helpful suggestions and advice. We could not have done this without the support of our team members. We are deeply grateful for them hard work, dedication, and creativity.

Finally, we would like to thank my family and friends for their love and support throughout this process.

ABSTRACT

Generation of municipal solid waste is ominously increasing due to the rapid growth of population coupled with the increasing scale of economic activity, i.e. urbanization, industrialization, and improved living standards. Urban local bodies across the world are struggling with the tenacious problems of municipal waste management, particularly in disposal of waste. Based on estimates, two Dhaka city corporations collectively generate about 1.6 million tons of municipal waste each year and emit approximately 1 million tons of GHG. This paper aims to evaluate the capacity of Dhaka North and Dhaka South City Corporations in handling waste against the mounting generation of MSW. The entire study is developed with secondary information but substantial primary information has been collected to update and to verify the information received from secondary sources.

TABLE OF CONTENT

ABSTRACT…… . vii

TABLE OF CONTENT…… viii

LIST OF TABLES …….. x

CHAPTER 1…… 01

1.1Back ground and history…….. 01

1.2 Waste Composition in Dhaka City Found in Different Studies. 02

1.3 Figure-1.1 DNCC &DSCC waste collection…… 03

1.4 Waste Management Practice in DNCC and DSCC…… 04

1.5 Table 1.1 Basic Information of Solid waste at DNCC and DSCC……. 05

Observation ……. …… 05

CHAPTER 2…….. 06

2.1 Waste Management Department of the DNCC and the DSCC…… 06

2.2 Ward conservancy activities…….. 07

2.3 Each of the city corporations was divided into 5 Zones for zone wise collection and transportation of solid waste in…… 07

Fig 2.1: Waste Collection Zones of DNCC and DSCC with Existing Landfill Sites 08

2.4 Zone Wise Waste Storage Facilities of DSCC and DNCC……. 08

Table 2.1 Zone wise Dustbins and Waste Containers of DSCC & DNCC…….. 08

2.5 Collection of municipal solid waste Primary collection and Cleaning 09

Observation ……. …… 09

CHAPTER 3…….. 10

3.1 Materials and Methods…… … 10

Table 3.1 Manpower in the Collection and Transportation…….. 11

Table :3.2 total field manpower generated…….. 11

3.2 Dumping of Waste at Landfill Sites ……..…… 12

Fig. 3.1 (a, b): Worn-out Situation of two permanent dumping stations in Dhaka 13

Observation ……. …… 13

CHAPTER 4…….. 15

4.0 Waste Collection Efficiency…… 15

Fig 4.1 DNCC & DSCC waste collection parcent…… .. 15

4.1 Composting Project in Dhaka Using PPP……. 16

4.2 Waste to Energy Project in Dhaka Using BOO……. 16

Fig;4.2 waste collected box…….. 17

Fig;4.3 waste collected box…….. 17

4.3 The Benefits of Recycling……. 17

Source : solid waste re cycling(fig-4.4 & 4.5)..... 20

Table 4.1 Greenhouse Gas Benefits Associated with Recovery of Specific Materials, 2012* (in millions of tons recovered, MMTCO2E and in numbers of cars taken off the road per year) ……. 20

4.4 Socio- Demographic Data of the Respondents..... 21

4.5 Practice of Hygiene by the Respondents..... 21

Fig-4.6 of the waste of medical summer..... 22

Table 4.2 of the waste of medical summer..... 22

Table 4.3. Medical wastes of Chattagram Medical College Hospital per day in different weeks March 2019 to August 2019..... 23

Table 4.4 total amount of waste RnMCH..... 24

Observation:..... 24

CHAPTER 5…….. 25

5.0 FINDING…….. 25

5.1 OBSERVATION…… 25

5.2 Recommendation…… 25-27

5.3 Conclusion…….. 27

LIST OF TABLES

1. Table 1.1 Basic Information of Solid waste at DNCC and DSCC……. 05
2. **Table 2.1 Zone wise Dustbins and Waste Containers of DSCC & DNCC…….. 08**

3. Table 3.1 Manpower in the Collection and Transportation…….. 11

4. Table :3.2 total field manpower generated…….. 11

5. Table 4.1 Greenhouse Gas Benefits Associated with Recovery of Specific Materials, 2012* (in millions of tons recovered, MMTCO2E and in numbers of cars taken off the road per year……. 2

6. Table 4.2 of the waste of medical summer..... 22

7. Table 4.3. Medical wastes of Chattagram Medical College Hospital per day in different weeks March 2019 to August 2019..... 24

8. Table 4.4 total amount of waste RnMCH..... 24

CHAPTER-01

INTRODUCTION:

1.1 Back ground and history

Bangladesh is the eighth most populous (World Population Review, 2023; World Atlas, 2023) country with the population of 172.96 million as of 20 April, 2023 (BBS, 2023) and the fifth most densely (World Atlas, 2023; Wikipedia, 2023) populated country in the world having 1175 persons living in sq. km (BBS, 2022). Like other countries, Bangladesh is also facing similar adversity as the amount of waste generated from domestic and commercial activities is increasing day-after-day in the large cities including the mega- city Dhaka (DoE, 2019). A study by Department of Environment (DoE) revealed that Dhaka's problem regarding solid wastes is worse compared to cities in other developing countries (DoE, 2019). According to the UNFPA report, Dhaka is one of the most polluted cities in the world and one of the concerning issues is the poor management of municipal waste (Bhuiya, 2007:29). Alamgir and Ahsan (2024) estimated a total of 25000 t of MSW generated daily in the six major cities (namely, Dhaka, Chittagong, Khulna, Rajshahi, Sylhet, and Barisal), while the Dhaka city contributed the most (69%, 5340 t) to the total waste stream. Rahman, et al., claimed that the waste in Dhaka comprises mainly 60% of organic waste which can produce landfill gas (methane) upon decomposition. Their observation from the GHG emission calculation on the basis of IPCC Guideline tier-1 revealed that 20.5 Gg and 16.96 Gg methane are emitted from the landfill sites at Dhaka City against 1710 ton and 1375 ton municipal solid waste in 2019 and 2014(Ahmed et al., 2019). Chowdhury, et al. (2019) assessed Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) collectively generate about 1.65 million tons of municipal waste

per year which emit approximately 1 million tons of GHG annually. These increasing rates of MSW create an adverse effect on environment as well as social and professional life of city residents, urban planners, developers, and other concerned stakeholders (AHMED et al., 2019).

World Health organization (WHO) has marked healthcare waste as harmful and hazardous waste and potentially dangerous of all waste appearance in communities (Sawalem *et al.,* 2009). Of the total quantity of waste produced by hospital activities, about 80% general waste that like household waste and other 20% is infectious, hazardous, toxic or radioactive waste. Medical waste is a serious threat to public health that requires immediate and special attention for safely handling and disposal. Besides, medical waste management (MWM) is such a public health issue due to containing germs and toxic chemicals (Akter and Trankler, 2003) that attracts the government of both industrialized and developing countries. If it is not managed timely and mixed with municipal solid waste, then it converts all into hazardous waste. Thus, it becomes difficult to handle and dispose large volume of medical waste. According to Pasupathi *et al* (2011) observed approximately 75-90% of medical waste is nonhazardous and as harmless as any other municipal waste

1.2 Waste Composition in Dhaka City Found in Different Studies

Several studies have been conducted by different authors to determine the composition of MSW generated in Dhaka city. Table-1 shows a comparison of the present study with different studies conducted earlier on municipal waste composition. As reported in the previous studies, organic matters varied over a wide margin ranging from about 62% to 88% during 1993-2005 in Dhaka city whereas, paper and plastic varied from about 1% to 11% and 1% to 7% respectively (Alamgir and Ahsan, 2019)

Collection Process Study based on Dhaka North City Corporation

- Municipal solid waste has been collected from twenty different locations (eighteen secondary collection points and two permanent land filling sites) of DNCC and DSC through Site Sampling

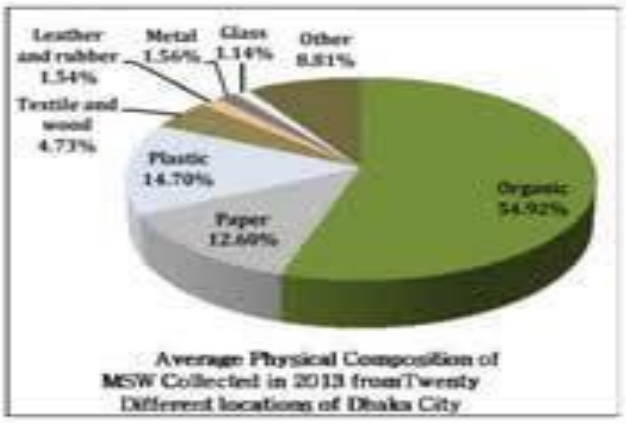


Fig 1.1 DNCC & DSCC waste collection

1.3 Waste Management Practice in DNCC and DSCC

The erstwhile Dhaka City Corporation had been working to improve the overall solid waste management of Dhaka city with the technical assistance of the Japan International Cooperation Agency (JICA) in 2000. A master plan on solid waste management titled Clean Dhaka Master Plan was formulated in 2005 and included a target year of 2015 to make the city of Dhaka clean (JICA, 2005).The master plan stressed on public awareness raising, primary collection, secondary collection, transportation and final disposal as well as administration and financial management. For the implementation of Clean Dhaka Master Plan, a technical cooperation project consisting of the dispatch of experts started in February 2007 and completed in February 2011 implemented by then DCC and JICA Expert Team (JICA, 2012).

Both the DNCC and the DSCC collect municipal wastes which are accumulated in corporations' bins or containers. Table 1 presents basic information of solid waste management at Dhaka North and Dhaka South City Corporations. From that table it can be seen in June 2020, total waste generation amount estimated for the DNCC was about 2486 tons/day and for the DSCC was about 3256 tons/day. The table also reveals that the DNCC was able to collect about 2486 ton of waste/day in June, 2020 whilst the waste collection capacity of the DSCC at that time was about 3256 tons/day.

Table 1.1: Basic Information of Solid Waste Management at DNCC and DSCC

Items	DNCC	DSCC
Number of Zones (2022)	10	10
Number of Wards (2022)	54	75
Waste Generation Amount (June, 2020)	Approx. 2486 t/day	Approx. 3256 t/day
Waste Collection Amount (June, 2020)	Approx. 3075 t/day	Approx. 2540 t/day
Waste Disposal Site	Amin Bazar	Matuail
Area of Disposal Site	20 hectare	63 hectare
No. of Ward SWM Offices	9	17
Number of Waste management Officials	257	352
Workshop	At Dholpur	

Source: Information collected by Field Survey (2020) from WMD of the DNCC

Observation:

1: We observed that need to proper waste management and quick remove wastage.

2: Pollution of the environment by humans should be reduced and garbage should be disposed of in specific places.

3: Need to assign more people the purpose of collecting all kind of waste from the municipal & hospital.

CHAPTER-02

Introduction:

Waste constitutes an inherent and unwelcome facet of human existence, and within the context of Dhaka city, Municipal Solid Waste Management (MSWM) emerges as a prominent environmental predicament . The escalation in demand, production, and consumption has led to a steady increase in the production of substantial quantities of solid waste, and for developing countries, such as Bangladesh, efficacious waste management remains a formidable challenge essential for the attainment of institutional

2.1 Waste Management Department of the DNCC and the DSCC:

Previously, each component of Dhaka's solid waste management system was implemented by separate government offices. Very recently a Waste Management Department has been formed in the light of the Clean Dhaka Master Plan to oversee waste operations. The Waste Management Department ultimately became responsible for solid waste management and is in charge of street and drain cleaning, carrying street and drain waste to dustbins/containers, and loading and unloading of waste to and from truck at places of dustbins/containers and disposal sites. Establishment of Waste Management Department aims at integrated solid waste management by one department with a unified chain of commands. With coordinated annual operation plans

and budgets, effective and efficient solid waste management can be achieved. With one department, integrated management throughout waste stream, from waste generation to final disposal can be realized (DNCC, 2019). Both the Waste Management Departments of DNCC and DSCC comprise a predominant portion of field workers and very few officers for planning and administration at headquarters. After inception, following functions are going on under the Waste Management Department of the DNCC and the DSCC:

2.2 Ward conservancy activities

Provide dustbins and other receptacles for accumulating the waste

Giving permission to PCSP (Primary Collection Service Provider) for door waste collection from household by van services

- Skill development program for primary waste collectors
- Establishment of secondary transfer stations
- Development and management of sanitary landfill
- Manage Private, Community and NGO based waste management activities.
- Hospital waste management
- Environmental education activities
- Repairing and maintenance of vehicles and equipment used for waste collection
- Promote projects for Gas to Power and Compost from Waste

2.3 Each of the city corporations was divided into 5 Zones for zone wise collection and transportation of solid waste in

landfill sites. Each of the zone has a zonal office consists of one Assistant Chief Waste Management Officer, two Conservancy Officers, one Conservancy Inspector for each ward, and two supporting staff. Apart from that waste cleaners and waste management drivers are distributed among the zonal offices and they work under the direct supervision of respective zonal office. In addition to this, Section 50 of the Local Government (City Corporation) Act, 2009

(Amendment in 2011) reads that the corporation shall form a standing committee in its first meeting of the year or as early as possible, on some specific issues including waste management. Each of those committees shall consist of some members selected among the councilors of the corporation, where the Mayor shall be a member of each committee as ex-officio. Each committee shall function for a period of 2 years and 6 months, which shall be formed afresh just after the tenure

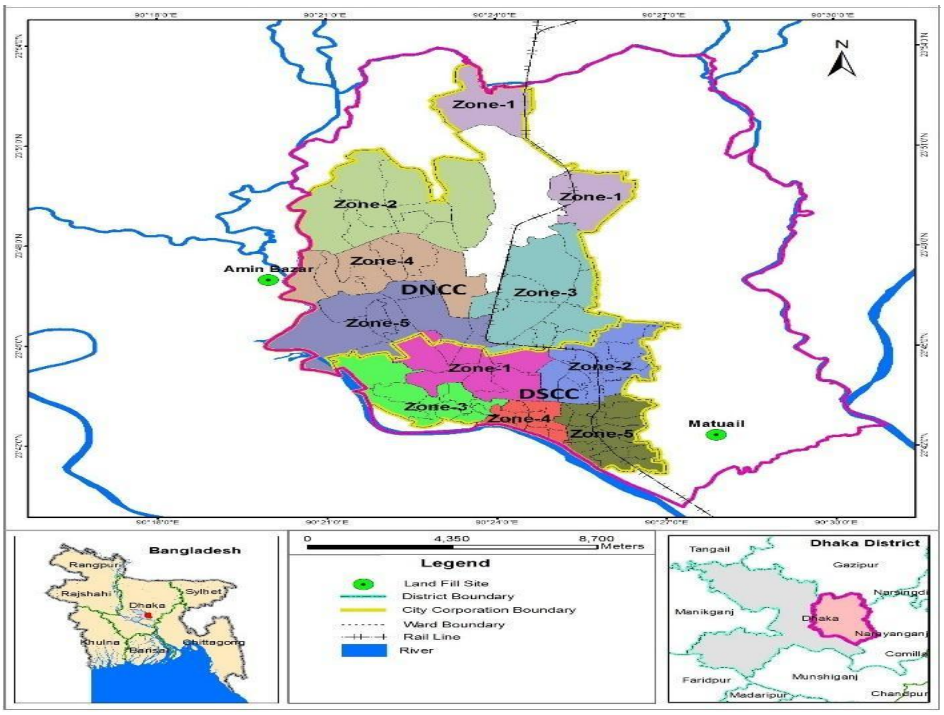


Fig. 2.1: Waste Collection Zones of DNCC and DSCC with Existing Landfill Sites

Source: Developed by Author, 2015

2.4 Zone Wise Waste Storage Facilities of DSCC and DNCC

Islam, et al.(2012) found total number of waste storage facilities are 1,098 units, which include 341 units of dustbins, 346 units of containers, 402 Temporary Collection Points (TCP), 7 Trailer Containers and 2 units of 12 m^3 containers as summarized in Table 3.

Table 2.1 Zone wise Dustbins and Waste Containers of DSCC & DNCC

Zone	Dustbin	Container	TCP
DSCC Zone-1 (Previous DCC Zone-5)	41	63	51
DSCC Zone-2 (Previous DCC Zone-4)	29	77	57
DSCC Zone-3 (Previous DCC Zone-3)	73	20	45
DSCC Zone-4 (Previous DCC Zone-2)	91	62	26
DSCC Zone-5 (Previous DCC Zone-1)	51	29	91
DNCC Zone-1 (Previous DCC Zone-10)	-	-	-
DNCC Zone-2 (Previous DCC Zone-8)	3	46	46
DNCC Zone-3 (Previous DCC Zone-9)	3	0	2
DNCC Zone-4 (Previous DCC Zone-7)	10	16	22
DNCC Zone-5 (Previous DCC Zone-6)	40	33	62
Total	341	346	402

Source: adapted from Islam, et al., 2019

2.5 Collection of municipal solid waste Primary Collection and Road/Drain Cleaning

Though residents are responsible for bringing their waste to the waste collection points, NGOs/CBOs/private sector provide primary collection services to collect waste door-to-door and transport the waste to dustbins, containers, or sometimes to vacant lands, by rickshaw vans. The private sector initiatives of NGOs and CBOs in primary collection services are now (2015) prevalent in wide areas of Dhaka city. Every morning cleaners sweep main roads, alleys footpath and put together the whole waste in a common place. Then bring it to the designated point/dustbin/container by hand trolley. Every day a team contains 10 to 12 cleaners send to the different location of ward for cleaning open drain/deep drain/surface drain and storm sewerage line (DNCC, 2014). Figure 4 shows primary collection of solid waste using Rickshaw Vans.



Fig: 2.2



Fig: 2.3

Observation:

1.We understood from this topics that,when we work waste management for a city,we devide the city two or three parts for collecting waste.

2. We collect all kind of waste by assign some waste collector organization.

3.Waste collect step by step by using different kind of vehicles from municipal and hospital to a big dumping zone for recycle and disposal it.

Writter name

1 . Ahmed.et.i . (2019).

2. Rahman, S. M. S., Shams, S., Mahmud, K. 2013

CHAPTER 03

Introduction:

This municipal waste disposal need to various materials for manpower, Waste management or waste disposal includes the processes and actions required to manage waste from its inception to its final disposal.

3.1 Materials and Methods

This study purposively selects 'X'[1] municipality of Bangladesh to observe the practices, problems and probable solutions regarding solid waste management. It is declared as a municipality on 10 July, 1996. Currently there are nine wards in the municipality. Table 1 lists ward-wise population distribution and estimated solid waste generation scenario in the municipality. Among the nine wards of the municipality, this study randomly selects five wards (ward no. 1, 4, 5, 6 and 9) for collecting primary data. A total of 175 respondents of the municipality are surveyed in year 2012 randomly taking 35 from each of the five selected wards. Voter list of the area is used to randomly select samples in the selected wards. Personal, socioeconomic and waste management related information is collected through a questionnaire survey from the sample respondents. Accordingly, this study analyzes the data collected from the field to grasp a clear picture about solid waste management practices, constraints and probable solutions. A five-point likert scale is used to measure the satisfaction level.

The dwellers of the municipality throw solid waste in various places like dustbin, drain, roadside and other crude dumping sites. The sweepers of the municipality usually collect wastes from crude dumping sites and dump in secondary dumping places like dustbins, from where a municipality truck collects waste and dump in the final dumping ground. There are 16 dustbins in the area during the survey period. The final dumping ground is about four km far from the municipal area. The municipality has 12 vans, three handcarts and one truck for collecting and dumping wastes (XM, 2012). Assuming four trips in the morning and three trips in the afternoon and 1.5 ton per trip carrying capacity, the municipality has the capacity to carry about two-thirds of generated waste to the dumping ground per day.

According to the survey data, most of the surveyed respondents are literate. About half of them have six to ten years of formal schooling, and another one-fourth of them have more than ten years of formal schooling, while the rests have five or less than five years of schooling experience or can sign only. About one-third of them are engaged in business, while other important occupation sources include government sector, teaching, private sector and agriculture.

3.1 Manpower in the Collection and Transportation

Estimated wasted generation

Ward no	population	area	Kg-capacity/day	Kg/day	percent
1	18250	747	0.27	4928	31
2	9500	38	0.29	2255	17
3	12200	181	0.15	1830	12
4	9020	227	.16	1373	9
5	10400	225	0.21	2096	13
6	7500	454	0.11	600	4
7	11600	328	0.12	811	5
8	10850	348	0.09	785	5
9	14583	718	0.08	597	4
Total	103903	3316	0.17	15803	100

Workers category	Number	
	DNCC	DSCC
Cleaner	3586	5300
Waste management driver	108	183
Central Garage	1	1
Number of waste carrying containers	180	255
Number of waste collection Trucks	115	235

3.2 Table : total field manpower generated

In Dhaka city, about cleaners 8900 (Field Survey, 2024) are employed for street sweeping and collection of waste found in places other than dustbin, road side, open spaces, ditches etc. by hand trolley (Islam, 2024).For collection of accumulated waste in 180 containers within 75 sq. km. area, the DNCC has 115 demountable container carrier trucks, where the DSCC has 235 demountable container carrier trucks to collect accumulated waste in 270 containers from its 42 sq. km. area (Field Survey, 2015). Manpower allocation to collection and transportation in DNCC and DSCC is summarized

3.2. Dumping of Waste at Landfill Sites

Most of solid waste was disposed of at landfill sites without any intermediate treatment in Dhaka as reported by JICA in 2005. JICA study (2005) also found three landfill sites used by DCC, namely, Matuail, Beri Band (Embankment) and Uttara. Hai and Ali found six dumping sites (1) Kulsi, (2) Chalkbari-Mirpur, (3) Gabtoli-Mirpur, (4) Lalbagh Shosan Ghat, (5) Mugdapara and (6) Jatrabari. DCC had already abandoned the sites after filling to their capacities (Hai and Ali, 2005). After partition of DCC, all garbage of DSCC is transported to Matuail landfill site while DNCC uses Amin Bazar landfill site for waste disposal (Field Survey, 2022).

In parallel with the technical cooperation activities, the Government of Japan supported other SWM activities in DCC including the improvement and expansion of Matuail landfill site and the construction of Amin Bazar landfill site under the Japan Debt Cancellation Fund (JDCF) as reported by JICA (2012). As stated about Matuail Landfill site by Yousuf and Rahman (2019), major sanitary landfill components introduced under the project were the leachate collection and gas venting systems, surface drainage improvement, systematic operation of waste disposal facilities by daily covering, slope reformation, working roads, weighbridge operation, and vehicle washing facilities. A semi-aerobic landfill system was adopted to reduce the polluting load on the environment and to speed up the stabilization of the disposed waste. A

perforated pipe network for leachate collection and gas venting was installed for the proper collection of the leachate and the provision of an air supply system (Yousuf and Rahman, 2007). Same sorts of facilities were



Matuail dhaka 2024



Aminbazar dhaka-2024

Fig. 3.1 (a, b): Worn-out Situation of two permanent dumping stations in Dhaka City

found in the Amin bazar landfill site during the field survey (2013). Though Matuail and Amin Bazar landfill sites have modern waste management facilities, those cannot be classified as sanitary landfill but controlled landfill. The dozer, chain dozer, scraper are being used to spread the waste regularly, hence waste pickers (TOKAI) salvage reusable materials from those dumping site. Figure 6(a, b) shows the worn-out situation of two permanent dumping stations in Dhaka.

Reference:

[12] .Bhuiya. G. M. J. A. 2007. "Bangladesh. Solid Waste Management: Issues and Challenges in Asia", pg 29, The Asian Productivity Organization (APO)

[13].Alamgir, M., Ahsan, A. 2007. "Municipal Solid Waste and Recovery Potential: Bangladesh Perspective", Iran. J. Environ. Health. Sci. Eng., 2007, Vol. 4, No. 2, pp. 67-76. Downloaded from http://journals.tums.ac.ir/ on Friday, October 12, 2013.

Observation:

1.We understood from this topics that if we collect waste in a proper way then will provide manpower from the root level to reach main dumping zone and select manpower on one areas population.

2.Also select the dumping zone far from the city so that any infectious disease cant attack or infect people.

3.Use modern technologies for disposal waste and also follow up the that waste who are buried underground from the soil surface cause of that waste contaminate the underground water table, which is a threat for every livelihood.

CHAPTER 4

Introduction:

The garbage collector provides the following benefits: Frees developers from having to manually release memory. Allocates objects on the managed heap efficiently. Reclaims objects that are no longer being used, clears their memory, and keeps the memory available for future allocations

4.0 Waste Collection Efficiency

The efficiency of EGAP vehicles received under the grant of Japanese government was found to be 4.05 ton/trip, while the efficiency of other DNCC/DSCC vehicles was foundto be 2.75 ton/trip as estimated by the city corporations (DNCC, 2015). Figure 8 illustrates percentage of trips generated by different type of vehicles per day and Figure 9 presents percentages of waste carried by different types of vehicles per day to Matuail and Amin Bazar landfills. Figure 8 reveals that 59%of trips are generated by city corporations' old waste collection vehicles and 36% are by EGAP vehicles and 5% are by private trucks. Figure 9 exhibits that city corporations' old vehicles carry 47% of total waste collected per day, where private trucks carry 11% and EGAP vehicles carry 42% of daily collected waste.

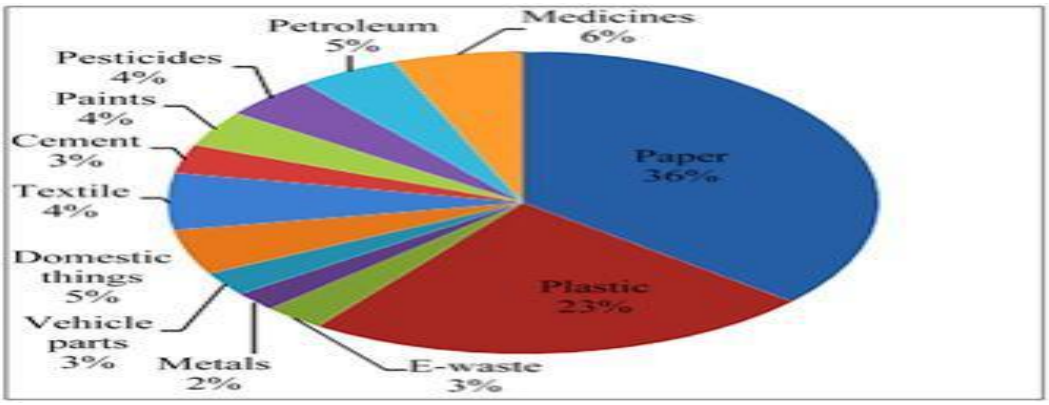


Fig 4.1 DNCC & DSCC waste collection parcent

4.1 Composting Project in Dhaka Using PPP

A BMDF study (2012) found that in 2012 Waste Concern was operating a large scale compost plant in Dhaka, Bangladesh, using PPP. The organization submitted the waste composting CDM project for approval to Designated National Authority in March, 2006 and the project was approved in July 2006. Subsequently, a 15 year concession agreement was signed with Dhaka City Corporation (DCC) in 2007(BMDF, 2012). This is the first concession agreement in solid waste recycling was launched in Bangladesh. Under this project, Waste Concern could collect up to 700 ton/day of organic waste (not mixed, only vegetable waste) incrementally starting from 100 ton/day (BMDF, 2012). Land for composting is arranged by the Waste Concern along with collection of organic waste. No waste collection fee or tipping charge is provided to Waste Concern by the municipality. Moreover, if Waste Concern fails to collect waste, there is a penalty clause of Tk. 250/ton for non-collection of waste. All the vegetable markets are under the jurisdiction of Waste Concern for collection of waste (BMDF, 2012). However, for the first plant of 100 tons per day capacity, DCC has allowed Waste Concern to collect waste from six vegetable markets of Dhaka and a daily monitoring is done by the municipality on amount of waste collected by Waste Concern as stated in BMDF (2012).

4.2 Waste to Energy Project in Dhaka Using BOO

BMDF study (2012) revealed that LGD under MoLGRD&C had signed an agreement with SRL via Priore Berengario of Italy to install a 10 MW power plant in which primary fuel would be the waste generated in Dhaka City Corporation (DCC). The power plant. waste per day generated in DCC. Would be The project would use 1,000 tons of implemented using Build Own Operate (BOO) system (BMDF, 2012). Under that project, DCC would provide the company with land at the landfill site and purchase electricity from the plant at a price agreed by the parties. The selected company would have to sign two separate agreements with DCC and Power Division, one for waste management and another for buying electricity. The project was not yet implemented (BMDF, 2012).

External Support:

A detailed study conducted by BMDF found that a project titled “Promotion of Source Separation of Waste in Dhaka and Chittagong was being implemented by DoE in partnership with two Dhaka city corporations and Chittagong city Corporation (BMDF, 2012). This project was implemented as part of the National 3R strategy to promote segregation of waste at source and promote recycling. The project was financed by Climate Change Trust Fund of Government of Bangladesh to promote segregation of waste (BMDF, 2012). From April of 2012, the 3R pilot project was launched in Dhaka's Gulshan, Baridhara, Gonobhaban (Mohammadpur), Dhanmondi, and Minto Road (BMDF, 2012).As part of the project, three bins were provided for 50,000 households in BMDF (2012 haka and Chittagong and an awareness raising campaign was also undertaken under this project as reported by). The study also revealed that segregated waste would be composted and based on the results of the pilot project, it would be gradually extended all over the city. Figure 7 shows the picture of three types of bins provided under this project for segregation of waste at sourc



Fig;4.2 open waste collected box



Fig;4.3 open waste collected box

4.3 The Benefits of Recycling

Recycling has environmental benefits at every stage in the life cycle of a consumer product—from the raw material with which it's made to its final method of disposal. By utilizing used, unwanted, or obsolete materials as industrial feedstocks or for new materials or products, Americans can each do our part to make recycling, including composting work. Aside from reducing GHG emissions, which contribute to global warming, recycling, including composting also provides significant economic and job creation impacts.The energy and GHG benefits of recycling and composting shown in Table 5 are calculated using EPA's WARM methodology (see: www.epa.gov/warm). WARM calculates and totals GHG emissions of baseline and alternative waste management practices, including source reduction, recycling, composting, combustion, and landfilling. Paper and paperboard recovery at about 44 million tons resulted in a reduction of 130 MMTCO2E in 2012. This is equivalent to removing 27 million cars from the road in one year. In 2012, nationally, we recycled and composted almost 87 million tons of MSW. This provides an annual benefit of more than 168 million metric tons of carbon dioxide equivalent emissions reduced, comparable to removing the emissions from over 33 million passenger vehicles from the road in one year.



Source : google web site fig-4.4 solid waste re cycling

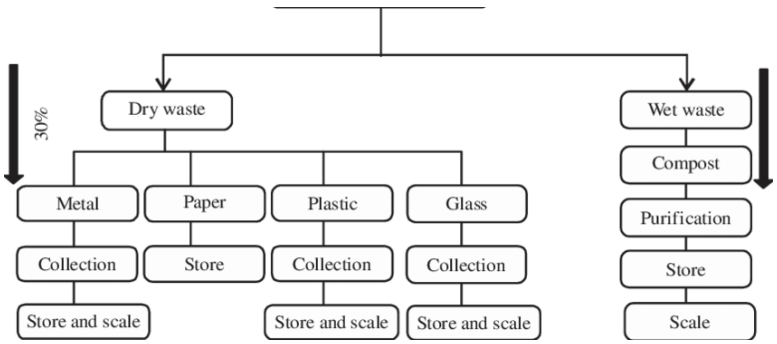


Fig 4.5 waste materials circle

Table 4.1 Greenhouse Gas Benefits Associated with Recovery of Specific Materials, 2012* (in millions of tons recovered, MMTCO2E and in numbers of cars taken off the road per year**)**

Material	**Weight Recovered (millions of tons)**	**GHG Benefits $MMTCO_2E$**	**GHG Benefits $MMTCO_2E$**
Paper and paperboard	44.4	130.5	130.5
Glass	3.20	1	1
Metals			
Steel	5.55	9	9
Aluminum	0.71	6.3	6.3
Other nonferrous metals†	1.36	5.3	5.3
Total metals	**7.62**	**20.6**	**20.6**
Plastics	2.80	3.2	3.2
Rubber and leather‡	1.35	0.7	0.7
Textiles	2.25	5.7	5.7
Wood	2.41	4.2	4.2
Other wastes			
Food, other^	1.74	1.4	1.4
Yard trimmings	19.6	0.8	0.8

4.4 Socio- Demographic Data of the Respondents

The respondents were mainly married slum women who are more informed about their family's health situation. Among the respondent majority of them were between the ages of 22 to 32 years. Most of the respondents in slums were unemployed and only few were working as domestic servants, employed as garment industry workers, and unskilled daily labour. After twelve years in 2010 the scenario was little bit different here majority respondent was working as domestic maid and rest were engaged in daily labour, garments industry and only few were housewife. Even from a study by World Bank in 2007 it was found that majority of poor female 16% poor female workers are engaged in domestic work and 32% of them engaged in garments industry and rest are.

4.5 Practice of Hygiene by the Respondents

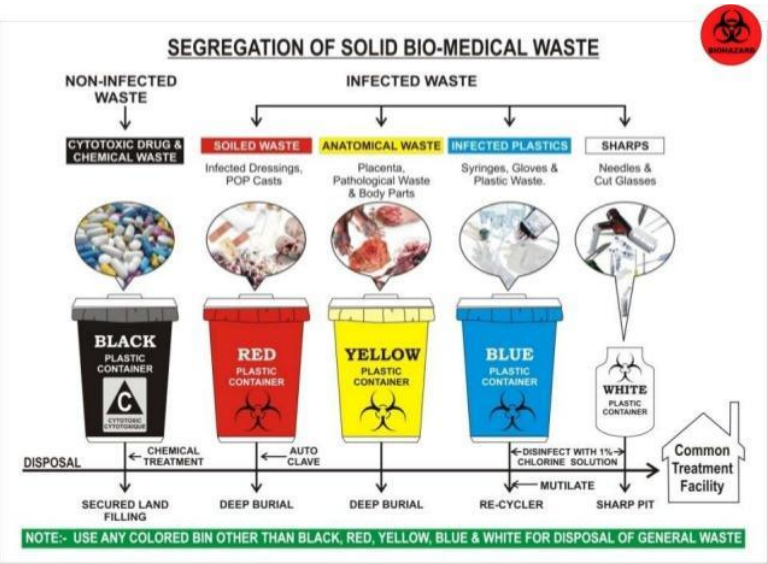
Health is a quality of life that renders the individual fit to live most and serve best. Attainment and maintenance of health may not be easy, because of improper living, the result of either ignorance or carelessness, and also due to the hazardous environment. The situations of slums are not very satisfactory. In a study it was found that majority respondent said that they live in very unhygienic environment and they all agreed that the slum had lead to disease or ill health in their families. The slum dwellers also felt that life in rural area was much better but poverty pushed them to this environment The health conditions in many developed worlds are below the desired level. There are many things about health that depends upon individual's desire and endeavour with the exceptions of heredity and constitution, which is known as personal hygiene. Therefore practice of personal hygiene or personal health care deals with measures that are the personal responsibilities of the individual for the promotion of good health. It is only when these become regular practices that the art of healthy living can be achieved. One important reason on healthy living is the promotion of good health habit. Habit grows by practice and eventually becomes a part of individual's daily life. It is an asset of life that regulates our eating, drinking, rest and sleep and evocation of bowels etc.

During this study period, data were collected from both the hospitals for 50 different days. Firstly, they were arranged on different day depending on their categories, mainly general and medical waste. It is very much pleasing to state that Jashore Medical College Hospital use colour coded bins to collect categorized wastes (Plate 1).

COLOR CODING FOR SEGREGATION OF BIOMEDICAL WASTE: -

COLOR	WASTE	TREATMENT
Yellow	Human & Animal anatomical waste / Micro-biology waste and soiled cotton/dressings/linen/beddings etc.	Incineration / Deep burial
Red	Tubing's, Catheters, IV sets.	Autoclaving / Microwaving / Chemical treatment
Blue / White	Waste sharps (Needles, Syringes, Scalpels, blades etc.)	Autoclaving / Microwaving / Chemical treatment & Destruction / Shredding
Black	Discarded medicines/cytotoxic drugs, Incineration ash, Chemical waste.	Disposal in secured landfill

Fig-4.6 of the waste of medical summer



Ward	Labour ward	Male surgery	Female medicine	Male surgery	Female surgery	Female paying	Child	Male medicine	Male paying	Emer-gency	CCU	Intensive Care	O.T
Ward No.	02	03	04	05	06	07	08	09	10	15	17	22	25
March 19	26.02	25.87	23.37	24.88	26.33	23.51	26.82	22.67	25.38	26.68	11.33	12.00	5.21
April 19	22.80	26.50	20.80	24.80	24.90	24.88	25.26	25.80	24.30	13.00	11.20	5.88	5.13
May 19	23.67	25.12	23.00	26.92	22.83	24.92	22.93	25.67	25.67	15.33	10.00	7.42	5.33
June 19	21.51	24.67	20.67	25.56	22.08	23.28	24.22	24.33	24.39	20.78	8.56	8.11	5.47
July 19	22.72	25.04	20.83	23.96	24.63	24.36	25.21	24.83	23.17	19.00	9.46	8.14	5.81
Aug 19	26.16	22.80	21.40	24.70	24.58	22.90	24.00	22.20	23.54	22.60	9.40	8.80	5.38

Table 4.2 of the waste of medical summer

Ward	Labour ward	Male surgery	Female medicine	Male surgery	Female surgery	Female paying	Child	Male medicine	Male paying	Emer-gency	CCU	Intensive Care	O.T
Ward No.	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**15**	**17**	**22**	**25**
March 19	2.45	1.66	1.90	2.08	2.57	2.26	1.89	2.22	2.07	2.29	1.38	1.79	1.70
April 19	1.83	1.72	1.70	1.80	1.79	1.76	1.84	1.79	1.91	1.61	1.47	1.61	1.54
May 19	1.83	1.74	1.80	1.91	1.84	1.79	1.76	1.92	1.92	1.64	1.50	1.61	1.68
June 19	1.88	1.67	1.80	1.96	2.00	1.87	1.85	2.17	1.91	1.71	1.50	1.68	1.75
July 19	1.83	1.63	1.84	2.04	1.97	1.79	1.81	2.19	2.07	1.72	1.75	1.71	1.80
Aug 19	1.95	1.56	2.04	2.02	2.49	1.96	1.92	2.02	2.11	2.16	1.37	1.78	1.75

Table 4.3. Medical wastes of Chattagram Medical College Hospital per day in different weeks March 2019 to August 2019.

Medical waste amount for a very little fraction, about one percent of the total amount of general wastes generated in Bangladesh (World Bank, 2002). But when this little amount of infectious waste in not controlled properly, it gets mixed with household general waste, and the whole waste become infectious and that waste

	Amount of waste (G+M) per day per bed in different wards of RnMCH									
Ward	Child	Delivery	Gynae 1, 3	Gyane 2 & ENT	Med M	Med F	Gastrology	Uroloy	Burn	Surgery
Ward No.	**8**	**11**	**12**	**13**	**29**	**30**	**33**	**34**	**37**	**15**
April--19	**0.87**	**1.65**	**1.51**	**1.38**	**0.76**	**0.94**	**0.43**	**0.37**	**1.03**	**1.03**
May--19	**0.90**	**1.70**	**1.51**	**1.38**	**0.77**	**0.92**	**0.43**	**0.38**	**1.03**	**1.04**
June--19	**0.91**	**1.73**	**1.62**	**1.36**	**0.73**	**0.88**	**0.43**	**0.37**	**1.00**	**1.01**
July--19	**0.91**	**1.69**	**1.55**	**1.38**	**0.75**	**0.92**	**0.44**	**0.35**	**1.02**	**0.99**
Average	**0.90**	**1.69**	**1.55**	**1.38**	**0.75**	**0.92**	**0.43**	**0.37**	**1.02**	**1.02**

Table 4.4 total amount of waste RnMCH

become dangerous for environment and health risk. Until recent past, there was no standard system for medical waste management in Bangladesh. Very recently, government of Bangladesh is trying to develop a system to control a standard medical waste management system.

References:

[1] Akter, N., Acott, R. E. & Chowdhury, S. A. (1998). Medical Waste Disposal at BRAC Health Centres: An Environmental Study.BRAC Research and Evaluation Division, 75 Mohakhali C/A, Dhaka 1212.

[6]. Longe, E. O., William, A. (2006). Preliminary study of medical waste management in Lagos metropolis, Nigeria.*Iranian J Environ Health Sci*.3(2):133–139.

[9]. World Atlas. 2015. http://www.worldatlas.com/aatlas/populations/ctypopls.,retrieve on 20April, 2015.BBS. 2015. http://www.bbs.gov.bd/home.aspx, retrieve on 20 April, 2015.

[11]. DoE. 2013. Bangladesh Environment and Climate Change Outlook (ECCO) 2012, Department of Environment, Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, published in June 2013.

[**12]** .Bhuiya. G. M. J. A. 2007. "Bangladesh. Solid Waste Management: Issues and Challenges in Asia", pg 29, The Asian Productivity Organization (APO),

Observation:

1.From this topics we understood that from the waste we made organic fertilizers, renewable products and other things, if we will set up modern waste management plants.

2.Must differently collect hospital and municipal waste, if both are mixed each other it will become infectious waste who become dangerous for environment and health risk.

CHAPTER 5

5.0 FINDING

The finding of the research study indicated that the chattagram Medical College Hospital (Sadar) Hospital) is standard for color coding segregation and treatment of system. PRISM Bangladesh controlled the waste management of chattagram Medical College Hospital. The Hospital authority and PRISM Bangladesh tries to follow WHO requirements, there is some turning from the standard guideline. But even now, the staff of chattagram Medical College Hospital have poor awareness about the waste collecting and disposing method. Some of the waste collectors use safety mask but most of them are not wear the masks. It has been noticed that most of the waste collectors do not use

hand gloves, boot and safety cloths. Sometimes waste collectors carrying waste in the bucket or tubs. But in dhaka Medical College Hospital a little guideline is maintained for waste collection. Even colour coded bins are not used to collect wastes.

5.1 OBSERVATION

The standard guideline of the waste collectors from all hospital should carry waste by trolley but often they carry waste in their own hand without hand gloves. Therefore, the standard medical waste management practice is highly needed for in hospitals. Most of the hospital staff are not proper trained, minimum guideline and supervisor. Moreover, the number of waste management staff is inadequate. Researchers, through seminars and workshop, advised the hospital waste collector's staffs about the need of proper training regarding the medical waste management.

5.2 Recommendation

There are a number of recommendations for the management of hazardous waste from healthcare or hospital. Medical facilities in different hospitals in Bangladesh that are characterized by the mismanagement refuse waste storage facilities, lack of proper knowledge and training of waste collectors, irregular disposal method and inappropriate protective gear for refuse waste collectors. Now in Bangladesh standard and scientific hospital waste management is a new appearance. Bangladesh government is trying to develop a standard and scientific method to deal with the healthcare waste properly. Canadian International Development Agency provide financial support to PRISM

Bangladesh. PRISM Bangladesh have recently gave standard disposal method for less cost hospital waste management in different city in Bangladesh. (PRISM, Bangladesh, 2005).

In the light of above observations made a number of recommendations are thereby made with the hope of improving the waste management system of Medical College Hospitals In order to arrange a standard and systematic medical waste management in hospitals, the following recommendations should be considered: Separating different categories of waste at the point of generation and keeping them separated from each other. By doing this, appropriate resources recovery and recycling techniques can be applied to each isolate waste. The total quantities of hazardous waste and infectious waste that must be treated according to special requirements are minimized. If not isolated, all medical waste must be treated as potentially infectious. To avoid the health and environmental risk effect from the infectious waste, it needed to formulate standard management regarding this issue.

The hospital waste management issue is becoming very critical in view of the growing quantities of medical risk waste, fast increasing HIV/AIDS incidence among certain groups. Planning of proper training regarding this issue could minimize the environmental and health risk. Moreover, the training could increase attention to human blood and fluid safety, disposal of syringe, blades, needles and other infectious waste. Infectious waste should be transported in wheeled leak proof containers. They should be clearly noted and systematically clean.

This hospital should develop the proper management of disposal of medical waste. It's very important to formulate a hospital waste management method separately from the healthcare waste management system. This should be don by including environmental health specialists in management team. For control infection, environmental health experts must be including in the management team in the hospital, as well as some waste management experts. This will decrease the environmental and human health risk. The hospital should offer regular proper training and education of all waste cleaners, from doctor to ward boy, laborer, waste collectors. Training is essential to develop awareness of health safety and environmental issue. It is also important for workers, waste collectors and cleaners to know and understand the potential risks associated with medical waste. And finally, the hospital must set a subcommittee in management team to be responsible for medical waste management system in the

hospital. The subcommittee should be in charge of periodic reviewing and resolving medical waste management issues in the hospital. This committee should also monitor the activities of the private waste management company to ensure that they perform their duties expected.

5.3 Conclusion

Municipal Solid Waste Management is a complex system considering its inclusion of various stakeholders from waste generation to management. Apart from this, a number of technical issues are correlated with the waste management system. The increasing amount of waste raises the demand of land for land filling and also increases the emission of GHG. The study reveals that both of DNCC and DSCC have taken the waste management issue seriously and the establishment of WMD is an indication of that seriousness. But in fact, some problems are hampering proper waste management by the city corporations such as, shortage of technical manpower and insufficient infrastructure facilities both at headquarters and zonal offices of WMD, insufficient regulations about waste management, and lack of awareness among the city dwellers about their role in waste management. It goes without saying that both the city corporations have to pull

References

[1] Akter, N., Acott, R. E. & Chowdhury, S. A. (1998). **Medical Waste Disposal at BRAC Health Centres**: An Environmental Study.BRAC Research and Evaluation Division, 75 Mohakhali C/A, Dhaka 1212.

[2] . Akter, N. & Trankler, J. (2003). An analysis of possible scenarios of medical waste management in Bangladesh. Management Environ Quality: *An Int. J*. **14(2):** 242-255.

[3] . Baveja, G., Muralidhar, S. Aggarwal, P. (2000), Hospital waste management - An overview, Hospital Today, **5(9),** 485-486.

[4]. Ahmed.et.i . (2019). **Solid waste management of Dhaka City**. Paper presented at the seminar on solid waste management.DCC. Dhaka. Bangladesh

[5]. Haque,M. M. Biswas, A., Rahman, M. S., Zaman K. B and Asiquzzaman, M. 2021. Observation on Medical Waste Management System in Rajshahi Medical College Hospital, Bangladesh IJESIR-NOVUS, **02(06),** 0100063 IJESIR Accepted.

[6]. Longe, E. O., William, A. (2006). Preliminary study of medical waste management in Lagos metropolis, Nigeria.*Iranian J Environ Health Sci*.**3(2):**133–139.

[7]. Olubukola, B.O (2009). Comparative Analysis of Health Care Waste Management Practice in Two General Hospitals in Nigeria.Available at ***http://www.eco-web.com/edi/index.htm***. Accessed January 28, 2011.

[8] . World Population Review. 2015. http://worldpopulationreview.com/countries/bangladesh-population/, retrieve on 20 April, 2015.

[9]. World Atlas. 2015. http://www.worldatlas.com/aatlas/populations/ctypopls.,retrieve on 20April, 2015.BBS. 2015. http://www.bbs.gov.bd/home.aspx, retrieve on 20 April, 2015.

[10]. Wikipedia. 2015http://en.wikipedia.org/wiki/International_rankings_of_Bangladesh,retrievedon 20 April, 2015.BBS. 2011. Population & Housing Census 2011, "Community Report", Bangladesh Bureau of Statistics, Bangladesh.

[11]. DoE. 2013. Bangladesh Environment and Climate Change Outlook (ECCO) 2012, Department of Environment, Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, published in June 2013.

[**12]** .Bhuiya. G. M. J. A. 2007. "Bangladesh. Solid Waste Management: Issues and Challenges in Asia", pg 29, The Asian Productivity Organization (APO), Tokyo, Japan.

[13].Alamgir, M., Ahsan, A. 2007. "Municipal Solid Waste and Recovery Potential: Bangladesh Perspective", Iran. J. Environ. Health. Sci. Eng., 2007, Vol. 4, No. 2, pp. 67-76. Downloaded from http://journals.tums.ac.ir/ on Friday, October 12, 2013.

[14].Rahman, S. M. S., Shams, S., Mahmud, K. 2013. "Study of Solid Waste management and its Impact on Climate Change: A Case Study of Dhaka City in Bangladesh". Retrieve from http://benjapan.org/iceab10/62.pdf on 15 April,