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Review

Waste generation and management in Bangladesh: An overview

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Abstract: This paper focuses on the status of solid waste generation, waste management system and waste management problems in Bangladesh. Solid waste generation is in increasing trend with the growth of urban population. The country is generating about 8000 tons of solid waste each day from the six major cities (Dhaka, Chittagong, Khulna, Rajshahi, Barisal and Sylhet), of which Dhaka city alone is contributing about 70%. Waste management system is not well organized. Efforts are underway to improve the system of waste collection, transportation, recycling, incineration and land filling. Lack of regulations/standard for waste disposal, landfill & use, lack of awareness, improper choice of technology and inadequate financial support are the major constraints for waste management in Bangladesh.

Keywords: solid waste; waste generation and management; Bangladesh

1. Introduction

The term waste is an unavoidable by product of human activities Economic development, urbanization and improving living standards in cities, have led to an increase in the quantity and complexity of generated waste. Rapid urbanization and population growth are largely responsible for increasing rate of solid waste generation in Bangladesh. This is a big threat to the environment and public health. Due to lack of motivation, awareness, proper selection of technology and adequate financial support, a considerable portion of wastes, 40-60%, are not properly stored, collected or disposed in the designated places for ultimate disposal (Ahsan *et al*., 2005). As a result, this solid waste creates environmental problems. The solid waste has four components: recycling, composting, land filling and waste to energy (WTE) via incineration.

In low-income countries like Bangladesh, much inorganic waste (such as plastic, metal, glass, etc.) is partially recycled by mainly informal sectors, while NGOs take the lead in composting of organic portion in limited scale and the recycling sector is not touched yet. Nevertheless, much of the organic portion as well as other, value-less waste remains a major problem. This often constitutes more than half by weight of the total MSW generated and requires costly removal and disposal (Ali, 2004).

With this contrast, the situation of waste management in Bangladesh is very alarming, poses serious health threats to humans and nature, and demands immediate and sustainable solutions. Hence, this study attempts to summaries the waste generation status, waste management system and waste management technology, existing legal framework related to waste management and problem associated waste management to ensure environmental sustainability.

2. Waste Generation

Solid waste generation in urban areas is increasing with the growth of population (Table 1). As reported by Alamgir and Ahsan (2007), a total of 7690 tons of municipal solid waste (MSW) is generated daily from the six major cities of Bangladesh, namely, Dhaka, Chittagong, Khulna, Rajshahi, Barisal and Sylhet, while the Dhaka city contributes 69% of the total waste stream (Table 2). The composition of the entire waste stream is about 74.4% organic matter, 9.1%paper, 3.5% plastic, 1.9% textile and wood, 0.8% leather and rubber, 1.5% metal, 0.8% glass and 8%other wastes. The factors that contribute to waste composition arepopulation density, life styles, economic conditions, fruit seasons, climate, recycling, and waste management program.

Table 1. Urban solid waste production in Bangladesh.

Year	Total urban population	Urban population (% total)	Waste production rate (kg/cap/day)	Total waste production (ton/day)
1991	20872204	20.15	0.49**	9873.5
2001	28808477	23.39	0.5***	11,695
2004	32765152	25.08	0.5***	16,382
2025	78440000	40.0	0.6 **	47,064

** Source: ADBI and ADB, 2000, *** Zurbrugg 2002

Table 2. Generation of different categories of wastes in six major cities of Bangladesh (Alamgir and Ahsan, 2007).

Waste category	Per capita waste generation (kg/day)						
	DCC	CCC	KCC	RCC	BCC	SCC	All waste stream
Organic matter	3647	968	410	121	105	158	5409
Paper	571	130	49	15	9	18	792
Plastic	230	37	16	7	5	8	303
Textile & wood	118	28	7	3	2	5	163
Leather & rubber	75	13	3	2	1	1	95
Metal	107	29	6	2	2	2	148
Glass	37	13	3	2	1	2	58
Others	555	97	26	18	5	21	722
Total	5340	1315	520	170	130	215	7690
Population	11.00	3.65	1.50	0.45	0.40	0.50	-
Per capita (kg/day)	0.485	0.360	0.347	0.378	0.325	0.430	0.387

DCC = Dhaka City Corporation, CCC = Chittagong City Corporation, KCC = Khulna City Corporation, RCC = Rajshahi City Corporation, BCC = Barisal City Corporation, SCC = Sylhet City Corporation

Table 3. Per capita generation of wastes in six major cities of Bangladesh (Alamgir and Ahsan, 2007).

Income level	Per capita waste generation (kg/day)						
	DCC	**CCC**	**KCC**	**RCC**	**BCC**	**SCC**	**Average**
A	0.504	0.378	0.368	0.343	0.327	0.429	0.392
B	0.389	0.343	0.333	0.320	0.278	0.395	0.343
C	0.371	0.350	0.319	0.242	0.247	0.340	0.312
D	0.305	0.253	0.264	0.309	0.269	0.248	0.275
E	0.270	0.189	0.203	0.239	0.172	0.260	0.222
Average	0.368	0.030	0.297	0.291	0.259	0.334	0.309
SD	0.090	0.079	0.065	0.047	0.057	0.080	0.070

High socio-economic (A), Middle upper socio- economic (B), Middle socio- economic (C), Middle lower socio- economic (D), Low socio- economic (E)

Per capita waste generation and percent composition of waste components are the two most important aspects for decision makers. This information helps identify waste components to target for source reduction and recycling programs. In high socio-economic family, daily waste generation rates are generally higher than other lower socio-economic families. The per capita generation rate was ranged from 0.325 to0.485 kg/cap/day, while the average rate was 0.387 kg/cap/day for the six major cities (Table 3). The waste is generated from different sources viz. domestic, commercial, industrial, street sweeping, health care facilities etc., of them domestic sources is dominant (Figure 1).

The rate of waste generation was found to be higher in the wet season and lower in the dry season, the waste generation rate per capita per day being 500 g in the wet season and 340 g in the dry season (JICA 2005).

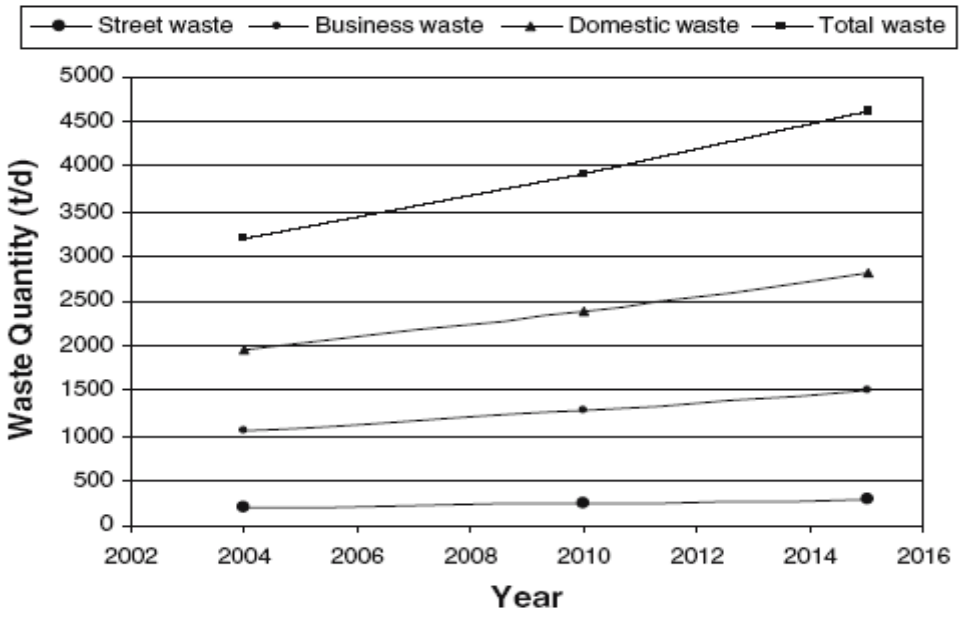

Figure 1. Forecast of solid waste generation amount from 2005–2015. (Source: JICA, 2005)

3. Waste Management

3.1. Waste Management System

Waste management system in Bangladesh is not well organized. Figure 2 illustrates the existing waste management process in Bangladesh.There are three systems of waste management in Bangladesh (DOE, 2004). One is the `Formal System', where municipalities/city corporations are responsible for Solid Waste Management (SWM). 'Formal system' is based on the conventional system of collection-transportation-disposal of waste carried out by the local authorities. In this system the concept of recycling is absent. Next is the `Community Initiative' that is based on primary solid waste collection by CBOs and NGOs, Finally,`Informal System' represented by the large informal labor force involved in the solid waste recycling trade chain. Partnership between these three systems is needed to promote effective solid waste management system in the country. Table 4 explains the technology and methods used to manage municipal solid waste.

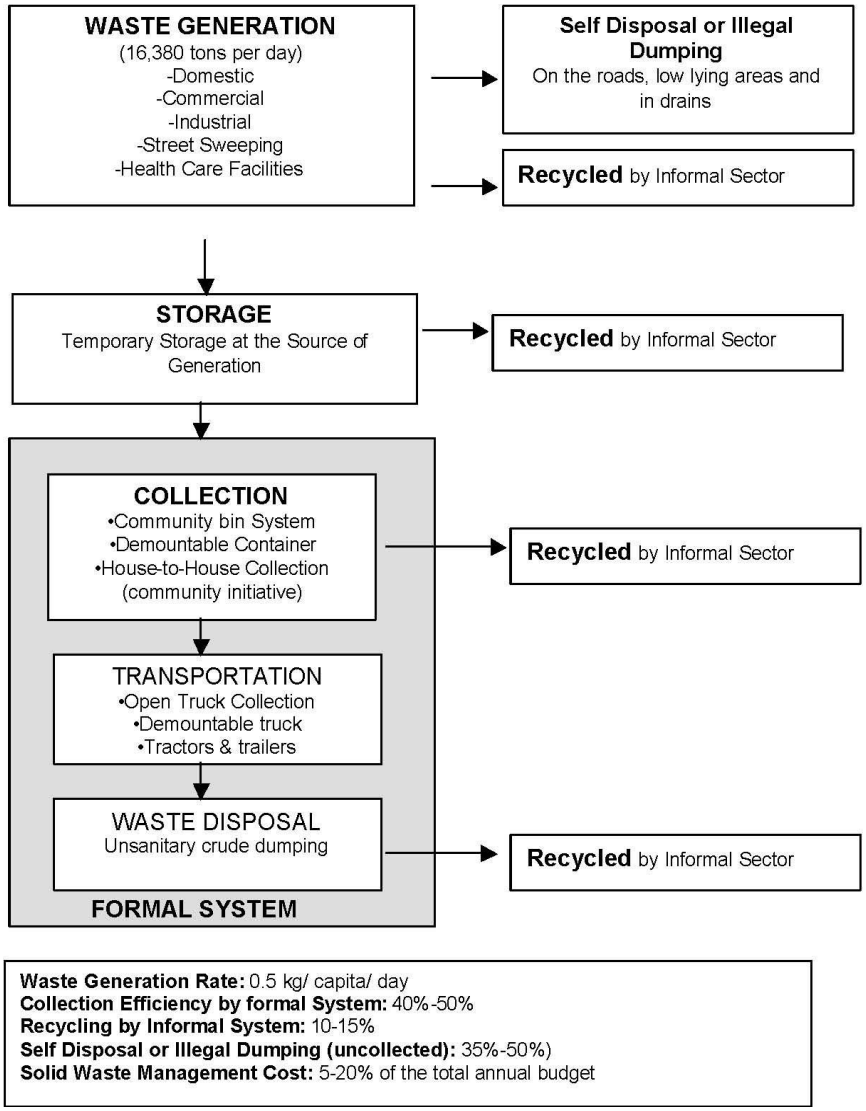

Figure 2. Solid waste management process in Bangladesh (DOE, 2004).

Table 4. Technology/ method used to manage urban solid waste (DOE, 2004).

Activity	Status in Bangladesh
Source Reduction	Limited official initiatives from the Government Reuse and recycling is done informally by informal sector. Segregation of recyclable waste with economic value (such as newspaper, bottles, cans, glass, plastic, metal, rubber and different containers etc.) is done at source by people and sold to buyers. Soiled recyclables materials from the source of waste, dustbins and dumpsites are retrieved by waste pickers for their survival.
Collection	No provision storage exists at or near the point of source of waste Waste is collected in the following ways: Community bin System (brick, concrete or corrugated iron sheet); Demountable Containers; House-to-House Collection system Designated Open Spaces
Transportation	Conventional open trucks, demountable containers and tractors and trailers for the collection of waste. No provision of transfer stations to transfer waste from the smaller collection vehicle to larger transport. Multiple handling of waste exists. Waste mixed with contaminated/ infectious substance Transportation does not synchronize with the capacity of collection points.
Recycling	Most recycling is done through the informal sector and waste picking. Mainly localized market and imports of materials for recycling. Presently local government bodies are replicating Waste Concern's model of community based composting in a number of cities Recently using Clean Development Mechanism (CDM) under the Kyoto Protocol Waste Concern along with WWR (a Dutch company) took an initiative for a 700 tons/ day capacity composting plant and land fill gas recovery project at the Matuail landfill site of Dhaka city.
Incineration	Not common or successful because of high capital and operation costs, high moisture content and low calorific value of waste makes waste not viable for incineration. At present few incinerators are used to manage health care related waste in a number of town and cities.
Land filling	Usually open crude dumping is adopted. This system is most unhygienic and inefficient. Causing problem to health and environment Hospital waste, toxic waste and untreated industrial waste are also disposed of at the municipal landfill.
Costs	5-20% of annual municipal budget is used for Solid Waste Management

3.2. Legal framework for solid waste management

There are national and local levels of legal framework in relation to solid waste management. They are stated below.

National Environmental Management Action Plan (NEMAP): The Ministry of Environment and Forest (MoEF) has formulated this action plan. NEMAP has recommended for actions in the areas of sanitation, solid waste management, water supply and environmental awareness etc. Based on the findings and recommendations of NEMAP, the government has taken up projects like community-based water supply and sanitation, community based solid waste management and community based wastewater treatment (GoB, 1995).
National Policy for Water Supply and Sanitation 1998: The Ministry of Local Government Rural Development & Cooperatives has prepared this policy. Special emphasis has been given on participation of private sector and NGOs in water supply and sanitation in urban areas. Some solid waste and recycling related strategies under this policy are given below:

- Local Government Bodies (City Corporations and municipalities) may transfer, where feasible collection, removal and management of solid waste to the private sector.
- Measures to be taken to recycle the waste as much as possible and promote use of organic waste materials for compost and bio-gas production
- Private sector including NGO participation in sanitation is encouraged (GoB,1998).

Local Level Legal Framework: There is no adequate legislation in the country to address the growing problems of solid waste. The responsibility of removal and disposal of municipal solid waste lies with the City Corporations and municipalities. The six City Corporation Ordinances and Pourshava Ordinance 1977 are the only local law that gives some idea about disposal of municipal waste.

3.3. Problems of Solid Waste Management

There are many problems and drawbacks of solid waste management in the urban areas of Bangladesh. The major ones are as follows:

- Absence of national policy to encourage recycling practice;
- Lack of proper handling rules and standard;
- Lack of finance, and inefficient tax collection;
- Inefficient practice of waste collection;
- Shortage of suitable lands for final disposal of solid waste;
- Lack of awareness about environmental problems associated with solid wastes
- Lack of partnership between public sector, private sectors and community groups

4. Recycling and Composting

For the developing countries, large centralized and highly mechanized small-scale decentralized community based composting plants can be considered as a suitable option for treating municipal solid waste as they reduce transport costs, make use of low-cost technologies, based mainly on manual labor, and minimize problems and difficulties encountered with backyard composting. Recently using Clean Development Mechanism (CDM) under the Kyoto Protocol Waste Concern along with WWR (a Dutch company) took an initiative for a 700 tons/ day capacity composting plant and land fill gas recovery project at the Matuail landfill site of Dhaka city. Very recently standard for composition of organic fertilizers including all wastes has been fixed in Bangladesh (Table 5).

Table 5. Standard of a quality organic fertilizer (BARC, 2007).

Parameter	Characteristics	Parameter	Characteristics
pH	5.5 - 8.5	Cu	Max. 0.05%
Organic carbon	10 – 25%	As	Max. 20 ppm
Total N	1.5 – 4.0%	Cr	Max. 50 ppm
C: N ratio	Max. 20:1	Cd	Max. 3 ppm
P	0.5 – 1.5%	Pb	Max. 30 ppm
K	1.0 – 3.0%	Hg	Max. 0.1 ppm
S	Max. 1%	Ni	Max. 30 ppm
Zn	Max. 0.1%	Inert material	Max. 2%

[Organic manure includes cowdung, FYM, poultry manure, compost, sewage sludge or any other waste]

5. Recommendations to be adopted:

Wastes may be turned in to resources by the following recommendations.

- Encouraging effort on recycling of organic waste.
- Proper management of clinical wastes Development of Public-Private-Community - Partnership, a model of management and sharing
- Promoting activity of civil society and environmental awareness group
- Establishment and development of micro-enterprises in waste recovery and recycling
- Ensuring involvement of NGOs and media in environmental awareness program.
- Effective and efficient coordination and cooperation among different divisions of City Corporation.
- Public awareness of the waste management should be raised through mass media for cooperation from city dwellers.
- Legal Aspect should be followed in opening a landfill. In connection with the existing landfill site, DCC should comply with Environment Conservation Act and Rules and Preservation Act.

6. Conclusions

Urbanization and Industrialization accompanied with population growth are the chief factors for increasing rate of solid waste generation in Bangladesh. About 8000 tons of solid waste is being generated each day from the six major cities of Bangladesh and the Dhaka city alone is generating about 70% of the total waste. The per capita waste generation is about 400 g/day. Waste management system is not very good. Efforts are being paid to improve the system of collection, transportation, recycling, incineration and land filling. However, with limited finances and organizational capacity, it has been really difficult for the government to ensure efficient and appropriate delivery of solid waste collection and disposal services to the entire population.

Conflict of interest

None to declare.

References

Ahmed MF, SAJ Shamsuddin, SJ Mahmud, H Rashid, D Deere and G Howard, 2005. Risk assessment of arsenic mitigation options (RAAMO). Dhaka. Arsenic Policy Support Unit.182 p.

Alamgir, M. and Ahsan, A. (2007). Municipal solid waste and recovery potential: Bangladesh perspective. Iran. J. Environ. Health Sci. Eng., 4: 67-76.

Ali M, 2004. Sustainable Composting. Water, Engineering and Development Center (WEDC), Loughborough University, UK.

Ali MM, H Ishiga and T Wakatsuki, 2003. Influence of soil type and properties on distribution and changes in arsenic contents of different paddy soils in Bangladesh. Soil Sci. Plant Nutr., 49: 111-123.

Asian Development Bank (ADB) and ADB Institute, 2000. "Partnerships for Better Municipal Management". Manila: ADB, Philippines.

BARC, 2007. Meeting of Technical Committee for Fertilizers Recommendation, held at BARC, Dhaka on 31 January 2007.

Department of Environment (DOE), 2004. Country paper: Bangladesh. Presented in the SAARC Workshop on Solid Waste Management, held at Dhaka during 10-12 October 2004.

Government of Bangladesh (GoB), 1995. "National Environmental Management Action Plan Final Report." Dhaka: Ministry of Environment and Forest.

Government of Bangladesh (GoB), 1998. "Urban Management Policy Statement." Dhaka: Ministry of Local Government Rural Development and Cooperatives.

Jahiruddin M, MR Islam and MA Ghani, 2003. Yield loss of rice due to use of arsenic contaminated soil and irrigation water. In Proc.: 7th International Conference on the Biogeochemistry of Trace Elements, Ed. Gobran, G.R. and Lepp N., vol. 2, pp. 78-79.

JICA, 2005. The study on solid waste management in Dhaka city. Clean Dhaka Master Plan, Final Report, Japan International Cooperation Agency, Pacific Consultants International, Yachiyo Engineering Co., Ltd.

Zurbrügg C, 2002. "Urban Solid Waste Management in Low-Income Countries of Asia How to Cope with the Garbage Crisis" paper presented for: Scientific Committee on Problems of the Environment (SCOPE) Urban Solid Waste Management Review Session, Durban, South Africa, November 2002.